Plan of A TOUR To CHINESE TATARY. &ca &ca &ca By William Moorcroft Esq.re in 1812
BRITISH MILES
HIMÁCHAL MOUNTAINS covered with perpetual snow
HIMÁCHAL Mts
CÁILÁS Mts
LAKE RAWAN HRAD
LAKE MÁPANG or MÁNAS-SARÓWAR
VALLEY of GORTOPE
URNA DESA or UN-DES
BHUTANT
PÁINKHANDI
Trisúla or Tir-súl Mountains
KHOL VALLEY
KAKLÁSIYON VALLEY
ALMÓRA
Bamúri
Rúdrapúr
Nánik-mathá

...Rajah. 1829

ASIATICK RESEARCHES;

OR,

TRANSACTIONS

OF THE

SOCIETY INSTITUTED IN BENGAL,

FOR INQUIRING INTO THE

HISTORY AND ANTIQUITIES,

THE

ARTS, SCIENCES AND LITERATURE,

OF

ASIA.

VOLUME THE TWELFTH.

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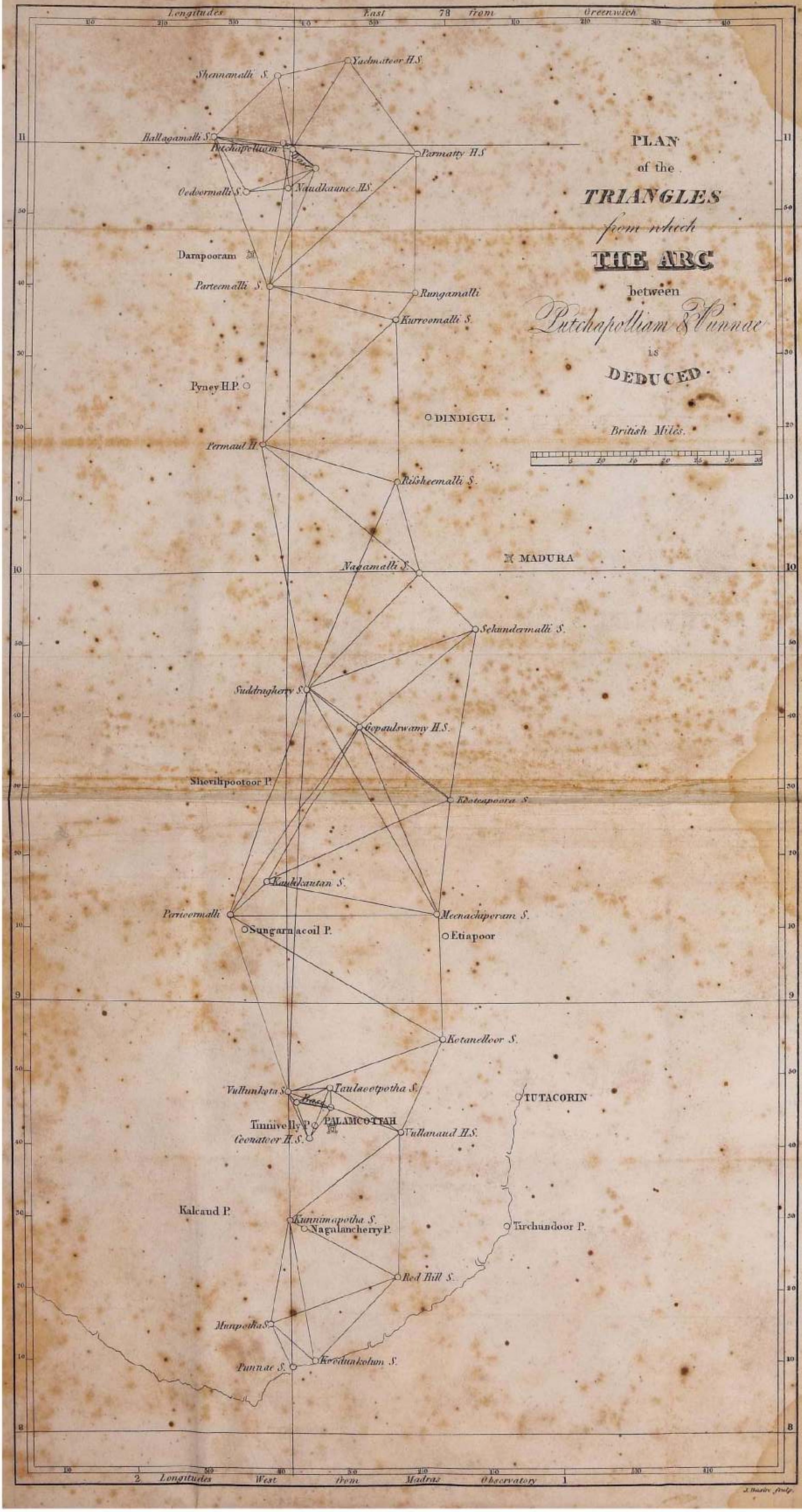

Longitudes East 78 from Greenwich
PLAN
of the
TRIANGLES
from which
THE ARC
between
Putchapolliam & Punnae
is
DEDUCED.
British Miles.
5 10 15 20 25 30 35
Yaelmateor H.S.
Shennamalli S.
Hallagamalli S.
Putchapolliam
Base
Parmatty H.S.
Oedoormalli S.
Naudkaunee H.S.
Darapooram
Parteemalli S.
Rungamalli
Kurroomalli S.
Pyney H.P.
DINDIGUL
Permaul H.
Rilsheemalli S.
MADURA
Nagamalli S.
Sekundermalli S.
Suddragherry S.
Gopaulswamy H.S.
Shevilipootoor P.
Kooteapoora S.
Kaulakautan S.
Perivormalli
Sungarnacoil P.
Meenachiperam S.
Etiapoor
Kotanelloor S.
Vullunkota S.
Taulaootpotha S.
Base
TUTACORIN
Tinnivelly P.
PALAMCOTTAH
Coonatoor H.S.
Vullanaud H.S.
Kalcaud P.
Kunnimapotha S.
Nagalancherry P.
Tirchundoor P.
Red Hill S.
Munpodka S.
Kroodunkolum S.
Punnae S.
2 Longitudes West from Madras Observatory 1
J. Basire sculp.

TRANSACTIONS

OF THE

ASIATICK SOCIETY.

LETTER from the Right Honourable the Governor General to the President, transmitting the following communication.

Fort St. George, 3d January, 1810.

SIR,

I HAVE the honour to transmit to you for the purpose of being laid before the Asiatic Society, a paper which I have received from Major WILLIAM LAMBTON of H. M. 33d Regiment of Foot, entitled, "An account "of the measurement of an Arc on the Meridian, "comprehended between the latitudes 8° 9′ 38″.39 and "10° 59′ 48″.93 North, being a continuation of the "grand Meridional Arc, commenced in 1804, and extending to 14° 6′ 19″ North."

I have great pleasure it being the channel of communicating to the learned Society, a paper containing matter of such high importance to the interests of science, and furnishing so many new proofs of the eminent endowments and indefatigable exertions which have long distinguished the character and labours of its respectable and meritorious author.

I have the honour to be, Sir,

Your obedient humble servant,

MINTO.

Hon. H. T. COLEBROOKE, &c. &c. &c.

I.

An Account of the measurement of an Arc on the meridian comprehended between the latitudes 8° 9′ 38″ .39 *and* 10° 59′ 48″ .93 *North, being a Continuation of the grand meridional Arc, commenced in* 1804, *and extending to* 14° 6′ 19″ *North.*

BY

MAJOR WILLIAM LAMBTON,

33d Regiment Foot.

IN a paper which I communicated to the *Asiatick* society, and which was published in the tenth volume of the Researches, I took an opportunity of noticing that a meridional Arc had been measured upwards of three degrees in amplitude. Being in expectation that the detailed account of that measurement would be transmitted to the Royal Society by the Honourable the Court of Directors, I have given no particulars of it here, but shall only notice the general results as combined with the operations hereafter mentioned. These meridional measurements being the chief foundation of the trigonometrical survey, which has been carried on under my direction for some years past, it is to be hoped that the *East-India* Company will be desirous of having them published along with the general account of the survey. But such a work being arranged in a great measure according to the order of time, must exhibit what is purely scientific, in a detached and mutilated form; it is therefore my intention to collect, at some future period, all the particulars that regard the comparison of celestial and terrestrial arcs, and digest them in a manner better prepared for the learned reader. The present period is replete with splendid performances in practical science, and although their objects be different, yet there result from each of them certain facts that tend to throw new light on various philosophical subjects. The grand operations in *France*, conducted

by the celebrated De Lambre and Me'chain, have for their object the determination of a standard measure; but, to accomplish that, they have measured an arc on the meridian upwards of nine degrees in length. The chief intention of the great survey in *England*, under Colonel Mudge, is to obtain a correct plan of the island of *Great Britain*, and the geographical positions of all known places, in latitude and longitude. In carrying this into effect, it was necessary to have a series of triangles in the direction of the meridian, from which has been deduced an arc of 2° 50′ 23″, which is to be extended northerly. The principal object of my own labours, when this work was first proposed to the *Madras* government, was to connect the two coasts of *Coromandel* and *Malabar*, and to determine the latitudes and longitudes of the principal places both on the coasts and in the interior. The original design has been vastly enlarged, and, in addition to the triangles carried across the Peninsula, between the latitudes of twelve and fourteen degrees, another series has been extended from *Tranquebar* and *Negapatam*, entirely across to *Paniany* and *Calicut*; and, to render the skeleton complete, a meridional series has been carried down the middle of the Peninsula, terminating at the sea near *Cape Comorin*, from which have been extended other serieses, to the east and west, entirely along both the coasts. From the above-mentioned meridional series, I have deduced an arc of nearly six degrees in amplitude. The members of the *Swedish* academy have likewise been performing a similar work; but the sole intention of that was, the measurement of a degree at the polar circle, as a test to the one executed by Maupertuis and his associates. These various performances have afforded the learned world the most extensive and the most accurate data hitherto obtained for determining a question of great importance in physical astronomy, viz. the dimensions and figure of the earth. This circumstance being involved in many abstruse speculations, re-

lating to the precesion of the equinoxes, the nutation of the earth's axis, the parallaxes of the moon, &c. &c. it has been found expedient, in order to make the theory agree with the observations of astronomers, to adopt a figure whose ellipticity was from $\frac{1}{300}$ to $\frac{1}{320}$, in place of $\frac{1}{230}$ given by Sir I. Newton: and various experiments, with pendulums in different latitudes, seemed to justify the measure. It will appear, in the sequel of this memoir, how far the recent measurements may be relied on in computing according to the elliptick theory; and certainly, from the great length of the arcs and their remoteness from each other, more reliance may be placed in computation drawn from them, than from any experiments made by such pendulums as have been generally used for those purposes.

The arc, which is the subject of this communication, is a continuation of the same meridian line, whose position was determined at the station of *Dodagoontah* in *Mysoor*, in 1805, and is the meridian on which the former arc was computed. The present arc commences at *Putchapolliam* station in *Coimbetoor*, where the former one terminated, and concludes at *Punnae* near *Cape Comorin*. The positions to the southward fall very favorably, and the place of observation at *Punnae* is only 98.2 feet east from the meridian of *Dodagoontah*. There is one station (*Permaul malli*) on a very lofty mountain, which has not yet been observed at, on account of the difficulty in getting at it; and besides, the season when I was in *Coimbetoor* was not favourable for ascending such high places. In consequence of this, there are four triangles wherein only two angles in each have been observed; an omission which at present must be dispensed with; but the base of verification near *Tinnivelly* will shew that no important error has crept into the operations.

The measurement of the base line in *Coimbetoor*, and the observations for the zenith distances of stars, were

completed in the beginning of 1806; but I have recorded them at full length here, as being the commencement of this section of the grand arc. The base near *Tinnivelly* was measured early in the present year, and the triangles continued to the southern station near the sea beach, a few miles east from the lines of *Travancore*. At this station, I sat down to observe the same stars which had been observed at *Putchapolliam*, and with equal success. Having finished there, I returned to *Palamcottah*, with an intention of making another set of observations, and for that purpose I erected a small observatory on the rampart of the fort, to be secure against the high winds; but the badness of the weather, occasioned by the setting in of the west monsoon, rendered all my endeavours fruitless. I have, however, reason to hope that the observations which have been made at the extremities of the arc will be thought satisfactory.

The length of the degree due to the middle point of this section of the arc, or latitude 9° 34′ 43″, is found to be 60473 fathoms nearly. Now it may be proper to notice here, what has already been noticed in giving an account of the former arc, that between *Dodagoontah*, in latitude 13°, and the station at *Bomasundrum*, in latitude 14°, there is a vein of iron ore, which was supposed to have affected the plummet, as some irregularity appeared to exist in the observations at those places. The arc between *Putchapolliam* and *Dodagoontah* gave the length of the degree for latitude 11° 59′ 54″ equal 60529 fathoms, and the arc between *Putchapolliam* and *Bomasundrum* gave the degree only 60449 fathoms reduced to the same latitude on the elliptick hypothesis. Seeing such a disagreement, it was necessary to recur to the nature of the country, as both those stations are sufficiently remote from mountains to remove any apprehension of a disturbance from them. But since no doubt remained as to the existence of some disturbing cause, I attributed it to the effects of this bed of ore, and concluded that the plummet had been drawn to the north-

ward while observing at *Dodagoontah*, and to the southward while at *Bomasundrum*, which would give the celestial arc between *Putchapolliam* and *Dodagoontah* too little, and that between *Putchapolliam* and *Bomasundrum* too great, the reverse of which would take place with respect to the length of the degrees in these two arcs. Being confident as to the accuracy of the observations at both places, and considering the circumstances just mentioned, I thought it reasonable to take the mean of the two degrees, which gave 60490 fathoms nearly, for the length of the degree in latitude 11° 59′ 54″.

Whatever may have been the cause of irregularity in the observations made at *Bomasundrum* and *Dodagoontah*, the errors occasioned thereby must be considerably reduced, when the whole arc, including the present measurement, is taken into account. I shall therefore take notice here what the general result gives, by comparing the arcs *Punnae* and *Dodagoontah*, *Punnae* and *Bomasundrum*, and *Punnae* and *Paughur*, which last place was also a station of observation in the former part of the operations.

It appears from Art. 8. that the celestial arc between *Punnae* and *Putchapolliam* is 2° 50′ 10″ .54; and the celestial arc between *Putchapolliam* and *Dodagoontah*, by the observations in 1805 and 6, was 2° 0′ 9″ .79; and therefore the sum is 4° 50′ 20′ .33, equal to the celestial arc between *Punnae* and *Dodagoontah*. The terrestrial arc between *Punnae* and *Putchapolliam* is 1029100.5 feet, to which add 727334.6 feet, the terrestrial arc between *Putchapolliam* and *Dodagoontah*, we have 1756435.1 feet or 292739.2 fathoms, which, compared with 4° 50′ 20″.33, will give the mean length of the degree, equal 60496 fathoms for latitude 10° 34′ 49″, the middle point of the arc.

The former celestial arc between *Putchapolliam*

and *Bomasundrum* was 3° 0′ 1″. 88, to which add 2° 50′ 10″ .54 gives 5° 50′ 12″ .42; and the terrestrial arc between *Putchapolliam* and *Bomasundrum* 1088275.8 feet, to which add 1029100.5 feet, gives 2117376.3 feet, or 352896 fathoms nearly, which compared with 5° 50′ 12″ .42, gives 60462 fathoms for the mean length of the degree in latitude 11° 4′ 44″ nearly, the middle point of the arc.

Again; the celestial arc between *Putchapolliam* and *Paughur* was observed to be 3° 6′ 37″ .78, and the celestial arc between *Punnae* and *Putchapolliam* is 2° 50′ 10″ .54, whose sum is 5° 56′ 48″ .32 for the whole celestial arc. The terrestrial arc between *Putchapolliam* and *Paughur* was 1128472 feet, to which add 1029100.5 feet, we have 2157572.5 feet, equal to 359595.4 fathoms, and this compared with 5° 56′ 48″ .32 gives 60469 fathoms nearly, for latitude 11° 8′ 3″, the middle point of the arc.

As the two last arcs are nearly of the same length, and the results differ but little, it has been thought sufficiently correct to take the mean of the two degrees as the measure due to the mean latitude of the two middle points, in which case we have 60466.3 fathoms for the length of the degree in latitude 11° 6′ 23″.5.

In order to get a mean result between the observations made at *Dodagoontah* and these two latter stations, the degree in latitude 10° 34′ 49″ has been taken and used with the degree in latitude 52° 2′ 20″, equal to 60820 fathoms; and with these the ratio of the earth's diameters has been computed, and found to be as 1 to 1.0030359 (Art. 2, Appendix); and thence the length of the degree in latitude 11° 6′ 23″ .5, has been found to be 60498 fathoms: therefore the mean between this and 60465.5 is 60486.75 fathoms; or, to avoid decimals, it has been called 60487 fathoms for latitude 11° 6′ 24″.

This mean measure has been used with the degree in latitude 52° 2′ 20″, and the ratio of the earth's diameters again computed, and the polar and equatorial diameters are found to be as 1 : 1.0031429, and I have made use of this for determining the lengths of degrees in different latitudes, by which the latitudes of all the great stations of observations in bringing down the grand arc have been finally fixed. And here it may be proper to observe that, in the tenth volume of *Asiatick Researches*, I have mentioned the latitude of *Dodagoontah* to be 12° 59′ 59″ .91, as determined by nine stars from the *Greenwich* observations of 1802; and from that the latitude of the observatory at *Madras* was deduced, and was found to be 13° 4′ 8″.7. But if it be allowed that the plummet has been drawn to the northward while observing at *Dodagoontah*, the observations at that place would give the latitude less than it really is. Under this conviction, I have made *Punnae* the fixed latitude, which was determined by eight of the same stars that were observed at *Dodagoontah*, and was found to be 8° 9′ 38″ .39 ; and by setting off from that parallel, and computing according to the lengths of the degrees given in Art. 3, Appendix, the latitude of *Dodagoontah* is found to be 13° 0′ 1″ .9 which is 2″ more than before, and therefore the latitude of the observatory at *Madras*, as deduced from that of *Dodagoontah*, will be 13° 4′ 11″ nearly.

After the deductions enumerated in this summary, the whole of the measurements both in *England*, *France*, and at the polar circle, have been compared, by using the degree in latitude 11° 6′ 24″, being the most southern of the recent operations ; and from these different data three ellipticities have been computed, and the mean taken, which will give an ellipsoid whose polar and equatorial diameters are to each other as 1 : 1.003242 nearly. From this, and the degree above mentioned, various conclusions have been drawn, in the appendix to this memoir, to which I shall refer the reader, and proceed

to give a detailed statement of all the particulars which are the immediate subject of this paper.

W. LAMBTON.

Trichinopoly, Nov. 1st., 1809.

---

1. *Measurement of the Base Line in the Coimbetoor.*

This base has been measured with the same apparatus, and in the same manner, as the base near *Bangalore;* an account of which has been given in the 10th volume of the *Asiatick Researches:* the whole operation has been conducted under my own immediate inspection.

Experiments made for comparing the Chains.

PREVIOUS TO THE MEASUREMENT.			AFTER THE MEASUREMENT.		
1806	Excess of the Old Chain.	REMARKS.	1806	Excess of the Old Chain.	REMARKS.
	DIVISIONS.			DIVISIONS.	
March 19th	19		April 19th.	28	
at 6 A. M.	19		at 6 A. M.	26	
	17.5			27.75	
	17.25			28.25	
	17.5			27	
6 P. M.	18.5	The mean		25.5	
	18	temperature		23.25	The mean
	20	during these		22.25	temperature
	19.25	experiments		23.25	during these
	18.5	was 86°. 12		22.25	experiments
	17			23.25	was 81°. 1
	18			25.75	
	17.5		20th	24	
	17.5		at 6 A. M.	24	
				24.75	
				24.75	
Mean	18.18		Mean	25	

TABLE

Containing Particulars of the Measurement.

[Commenced on the 20th of March, 1806.]

Number of the Hypothenuse.	Length of each in Feet.	Angles of Elevations and Depressions.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.
				Ascents.	Descents.	Above.	Below.	
		° ′ ″	FEET.	FEET.	FEET.	INCHES.	INCHES	°
1	100	0 25 0	.00264	0.7270		23.		100.2
2	300	1 5 30	.05445		5.7165	2.75		95.8
3	400	1 3 50	.06896		7.4280		2.5	103.4
4	100	Level				1.1		115.2
5	400	0 42 30	.01528	2.7430				77.7
6	400	0 18 30	.00580		2.1540		6.5	94.
7	300	0 51 40	.03387		4.5090		7.6	108.5
8	200	1 20 0	.05416		4.6540		3.1	95.9
9	300	1 51 0	.15636		9.6840		2.4	74.9
10	500	0 27 25	.01590		3.9854	9.1		93.2
11	100	1 29 5	.03357	2.5914		24.1		114.2
12	300	0 43 35	.02412	3.8038				74.3
13	500	Level					3.	87.
14	200	1 1 25	.03192		3.5722	0.2		104.3
15	300	0 10 10	.00129	0.8875		2.5		109.4
16	100	2 13 55	.07587		3.8946		9.4	76.4
17	100	0 5 30	.00013		0.1600	12.1		80.
18	200	1 10 55	.04256	4.1252		7.5		87.0
19	400	1 38 35	.16444	11.4677		5.2		98.4
20	400	1 1 20	.06364	7.1347			8.5	112.0
21	200	0 11 10	.00106		0.6497		7.5	75.6
22	100	1 54 40	.05563		3.3354		8.5	80.4
23	100	2 3 50	.06487		3.6012		4.2	81.8
24	200	1 8 30	.03970	3.9850			19.3	90.6
25	400	0 9 10	.00140		1.0673		1.7	101.5
26	400	0 55 35	.05228		6.4677		9.2	95.6
27	300	1 9 40	.06159		6.0790		2.1	80.6
28	600	0 44 5	.04932	7.6945		17.		96.2
29	500	1 3 35	.08550	9.2446		12.		106.4
30	500	0 30 0	.01905	4.3650			9.2	76.8
31	400	0 31 0	.01628	3.6080				84.1
32	200	0 35 45	.01080		2.0795		7.8	93.1
33	500	1 40 10	.21220		14.5641			102.2
34	200	0 51 0	.02200		2.9660	10.5		113.9
35	400	0 11 50	.00236	1.3767			11.6	79.1

Number of the Hypothenuse.	Length of each in Feet.	Angles of Elevations and Depressions.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.
				Ascents.	Descents.	Above.	Below.	
		° ′ ″	FEET.	FEET.	FEET.	INCHES.	INCHES	°
36	400	0 46 50	.03712	5.4487				93.3
37	300	0 38 0	.01833	3.3150			14.9	109.7
38	400	1 7 0	.07596	7.7960		10.		78.9
39	400	0 40 0	.02708	4.6560				85.1
40	400	0 33 15	.01872	3.8960			7.5	98.8
41	400	0 17 15	.00504	2.0090				114.2
42	400	0 46 25	.03648		5.4003		11.2	78.0
43	500	0 57 30	.06995		8.3625			92.3
44	300	0 45 25	.02619		3.9632			107.7
45	200	0 51 40	.02258		3.0047			115.2
46	100	0 44 0	.00819		1.2800			124.4
47	300	0 54 35	.03783	4.7638		23.5		77.0
48	500	1 22 15	.14305	11.9612		9.4		88.
49	200	0 50 50	.02186	2.9563				97.6
50	300	0 30 0	.01143	2.6190				106.4
51	400	0 48 55	.04052		5.6903			116.4
52	100	0 37 0	.00579		1.0760			77.4
53	300	0 30 0	.01143	2.6190		30.3		79.7
54	300	0 10 0	.00126	0.8730			7.3	90.
55	500	0 27 50	.01640	4.0458				100.4
56	400	0 31 25	.01672	3.6563				109.9
57	300	0 44 45	.02541	3.9052				77.6
58	300	0 19 40	.00492	1.7170				89.8
59	300	0 10 0	.00126		0.8730			100.5
60	300	1 20 15	.08175		7.0027			108.7
61	100	0 25 55	.00284	0.7536		7.5		117.6
62	100	0 33 35	.00477	0.9769				122.4
63	300	0 35 20	.01584	3.0830		28.7		77.7
64	400	0 25 25	.01092	2.9563			5.6	82.5
65	100	0 18 35	.00146		0.5409			89.4
66	100	0 33 40	.00480		0.9793		9.	96.4
67	200	1 40 0	.08460		5.8160			100.5
68	200	1 44 0	.09152		6.0500		6.1	78.1
69	100	0 4 45	.00010		0.1377	11.5		79.4
70	200	1 37 15	.08002	5.6565		7.5		84.8
71	400	1 41 5	.17292	11.7617				92.4
72	200	1 40 0	.08460	5.8160				101.6
73	100	2 16 15	.07853	3.9622		8.		110.6
74	300	1 1 0	.04722		5.3220			77.9
75	600	1 10 25	.12588		12.2885		9.7	86.5
76	300	0 4 10	.00024		0.3625	16.4		99.4
77	200	1 37 45	.08084		5.6855			110.

Number of the Hypothenuse.	Length of each in Feet.	Angles of Elevations and Depressions.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.
				Ascents.	Descents.	Above.	Below.	
		° ′ ″	FEET.	FEET.	FEET.	INCHES.	INCHES	°
78	100	0 5 55	.00015		0.1716	5.5		116.
79	200	0 30 0	.00762	1.7460				76.4
80	400	1 6 50	.07560	7.7767		11.7		85.1
81	400	1 4 45	.07094	7.5350				95.8
82	600	1 34 30	.22668	16.4910		12.		107.7
83	400	1 0 0	.06092	6.9800			5.4	80.
84	300	0 26 10	.00870		2.2825			87.6
85	200	0 54 10	.02484		3.1517		7.7	96.7
86	300	1 32 25	.07252		5.3858	3.8		99.9
87	300	0 16 55	.00363	1.4747		15.5		111.2
88	400	1 39 30	.16752	11.5740		8.1		79.4
89	400	1 15 30	.09648	8.7820				81.8
90	400	1 4 40	.07076	7.5253				89.7
91	300	0 22 5	.00621	1.9273				95.9
92	200	1 22 5	.05700	4.7748		17.8		104.8
93	200	1 34 55	.07624	5.5212		9.5		111.5
94	400	0 30 30	.01576	3.5500				74.4
95	300	Level						79.9
96	300	0 35 40	.01614		3.1120		10.6	88.7
97	100	1 6 35	.01876		1.9369		34.3	93.2
98	100	Level						95.2
99	300	0 54 55	.03828	4.7927				77.8
100	200	0 5 40	.00028		0.3287			79.4
101	300	0 23 5	.00678		2.0143		8.4	88.7
102	300	0 32 50	.01368	2.8655		10.6		98.8
103	300	1 44 10	.13773	9.0895				104.8
104	700	1 7 5	.13328	13.6599				79.1
105	700	1 1 0	.11018	12.4180				89.5
106	500	1 17 50	.12815	11.3208		7.8		98.2
107	200	0 5 30	.02158	2.9370			31.6	109.2
	32300		4.85778	307.4020	178.7862	382.85	311.2	94.03

[Completed on the 19th of April, 1816.]

N.W. end, above the S.W. end of the base, 134.8 Feet in perpendicular height.

	Feet.
At the commencement, the old chain exceeded the new one 18.18 divisions of the micrometer, equal .00728 feet. Therefore 323 × 100.00728 feet will be the measure in terms of the new chain -	=32302.3514
At the conclusion, the old chain exceeded the new one 25 divisions, and had therefore increased 6.82 divisions, equal .00273 feet. Hence $323 \times \frac{0.00273}{2}$ =0.4409 feet, the correction for the wear, which add	+ 0.4409
The sum of the deductions from col. 4th is 4.85778 feet, which being increased in the ratio of 100 to 100.0072 will be 4.8581 feet, which subtract	— 4.8581
Hence the apparent horizontal distance will be	32297.9342
The correction for the expansion and reduced to the standard temperature of 62° will be $\frac{(94^\circ.03-50^\circ)\times .0074-(62^\circ-50^\circ)\times .01237}{12}$ × 32297.9342 feet, which add	+ 4.7744
Hence the corrected measure of the Base for the temperature of 62° will be .	32302.7086
Which, being reduced to the level of the sea, will be	32301.2769

The last reduction is applied to the S. E. end of the Base, which is nearly the mean height of all the hypothenuses, and is 925.5 feet above the level of the sea; which height was determined by bringing down the triangles from the station at *Dodagoontah*.

2. ANGLES

At the N. W. End of the Base Line.

BETWEEN	AND	°	′	″	Mean ″
S.E. end of the Base..	Naudkaunee hill	46	18	22.5	22.12
				21.75	
	Oodoormalli	87	3	52.25	53.7
				54.5	
				56.25	
				53.25	
				52.25	
	Hallagamalli	142	32	41	41.25
				41	
				40.75	
				42.25	
Naudkaunee hill	Oodoormalli	40	45	29.75	31.25
				32.75	
Oodoormalli	Hallagamalli	55	28	49	47.55
				46.75	
				45	
				48	
				49	
Hallagamalli	Shennimalli	77	17	19	15.65
				14.75	
				15.75	
				14.75	
				14.	

At the S. E. End of the Base Line.

BETWEEN	AND	°	′	″	Mean ″
N.W. end of the Base..	Naudkaunee hill	77	29	12.25	12.
				10.25	
				12.	
				13.5	
	Oodoormalli	61	23	45.25	47.4
				47.75	
				48.75	
				47.75	
				47.5	

At the S. E. End of the Base (continued).

BETWEEN	AND	°	′	″	Mean ″
Oodoormalli	Hallagamalli	36	30	18.25	
				14.25	
				15.	15.3
				13.	
				16.	
Hallagamalli	Shennimalli	50	27	50.	
				52.5	
				49.75	49.94
				47.5	
Hallagamalli	Yaëlmatoor hill	88	44	35.75	
				27.5	30.92
				29.5	
Shennimalli	Yaëlmatoor hill	38	16	42.	
				39.5	39.75
				37.75	
Yaëlmatoor	Parmatty hill	67	51	2.	
				0.25	1.67
				2.75	
Hallagamalli hill	Purteemalli	86	0	11.	14.12
				17.25	
Parmatty hill	Purteemalli	117	24	25.5	
				24.5	22.42
				17.25	
	Rungamalli	58	53	40.25	
				33.5	34.25
				29.	
Purteemalli	Rungamalli	58	30	45.25	
				51.	48.17
				48.25	
	Putchapolliam Station	112	5	9.87	9.87
Yaëlmatoor hill	Putchapolliam Station	62	39	27.	
				29.5	27.25
				25.25	

At Naudkaunee Hill.

N.W. end of the Base	S.E. end of the Base	56	12	26.	
				26.25	25.67
				24.75	
	Oodoormalli	95	2	17.	
				14.	15.67
				16.	

At Oodoormalli.

BETWEEN	AND	°	′	″	Mean ″
N.W. end of the Base	S.E. end of the Base	31	32	23. 19. 20.5 20.5	20.75
	Naudkaunee hill	44	12	15.5 14.25 11.75 14.75	14.06
	Hallagamalli	69	57	13.75 13.25 12.25	13.08
Hallagamalli	S.E. end of the Base	101	29	32.75 33.75 32.75	33.08

At Halagamalli.

BETWEEN	AND	°	′	″	Mean ″
N.W. end of the Base	Oodoormalli	54	34	3.75 5. 5.25	4.67
S.E. end of the Base	Oodoormalli	42	0	12.5 14. 15.25	13.92
Shennimalli	N.W. end of the Base	47	48	24. 22.5	23.25
	S.E. end of the Base	60	22	15.25 10.75 13.75	13.25
S.E. end of the Base	Yaëlmatoor hill	47	31	18.75 24.	21.37
Yaëlmatoor hill	Parmatty hill	36	0	13. 10.25 9.	10.75
Parmatty hill	Parteemalli	63	49	38.5 36. 38.5 36.5 42.5	38.4
Kautpolliam (S.E. end of the Base)	Parteemalli	52	18	33.5 32.25 37.5	34.42

At Shennimalli.

BETWEEN	AND	°	′	″	″
N.W. end of the Base..	Hallagamalli	54	54	23.5	
				24.25	23.83
				23.75	
S.E. end of the Base..	Hallagamalli	69	9	58.75	
				62.	60.83
				61.75	
	Yaëlmatoor hill	82	1	32.5	
				27.75	30.
				29.75	
Yaëlmatoor hill	Putchapolliam Station..	92	57	34.75	
				35.25	
				35.75	35.69
				37.	

At Putchapolliam Station.

Shennimalli..........	Yaëlmatoor hill......	43	39	0.25	
			38	58.25	1.19
			39	3.5	
				2.75	
Yaëlmatoor hill	S.E. end of the Base..	101	2	8.5	
				8.9	8.73
				8.8	

At Yaëlmatoor Hill.

S.E. end of the Base ..	Hallagamalli	43	44	10.	
				8.5	
				7.	9.06
				10.75	
	Shennimalli	59	41	46.5	
				44.25	45.58
				46.	
Shennimalli	Putchapolliam Station	43	23	25.75	
				20.75	23.25
S.E. end of the Base ..	Putchapolliam	16	18	23.25	
				21.	22.33
				22.75	

At Parmatty Hill.

BETWEEN	AND	°	′	″	Mean ″
Hallagamalli	Yaëlmatoor hill	48	16	14.5	10.75
				11.	
				7.25	
				10.25	
Yaëlmatoor hill	S.E. end of the Base	60	9	41.25	39.75
				40.25	
				37.75	
				39.75	
S.E. end of the Base	Rungamalli	81	54	30.25	58.67
				59.75	
				56.	

At Purteemalli.

BETWEEN	AND	°	′	″	Mean ″
Hallagamalli	Parmatty hill	69	25	39.5	37.33
				34.	
				38.5	
	S.E. end of the Base	41	41	14.	13.0
				13.5	
				11.5	
S.E. end of the Base	Parmatty hill	27	44	17.5	21.17
				25.5	
				20.5	
	Rungamalli	72	57	48.	51.38
				52.	
				51.	
				54.5	
Parmatty hill	Kurroomalli	56	39	13.5	13.8
				15.	
				13.	
S.E end of the Base	Kurroomalli	84	23	28.5	29.13
				32.5	
				26.5	
				29.	
Rungamalli	Kurroomalli	11	25	31.5	35.8
				37.	
				40.5	
				35.5	
				34.5	

At Purteemalli (continued).

BETWEEN	AND	°	′	″	Mean
Kurroomalli	Permaul hill	77	20	47.5	49.21
				51.	
				50.5	
				47.	
				50.75	
				46.75	
				51.	
Hallagamalli	S.E. end of the Base ..	41	41	13.	
S.E. end of the Base ..	Parmatty hill	27	44	21.17	
Hallagamalli	Parmatty hill	69	25	34.17	
Ditto	Ditto (observed direct)	69	25	37.33	
	Mean......	69	25	35.75	
Parmatty hill	S.E. end of the Base ..	27	44	21.17	
S.E. end of the Base ..	Kurroomalli	84	23	29.13	
Kurroomalli	Parmatty hill........	56	39	7.96	
Ditto	Ditto (observed direct)	56	39	13.8	
	Mean......	56	39	10.88	

At Kurroomalli.

BETWEEN	AND	°	′	″	Mean
Purteemalli..........	Parmatty hill	82	17	50.5	52.71
				48.75	
				48.5	
				55.5	
				56.	
				57.	
	S.E. end of the Base ..	46	53	12.	12.8
				15.5	
				15.	
				10.5	
				11.	
	Rungamalli	110	54	37.5	37.44
				41.25	
				34.5	
				36.5	

At Kurroomalli (continued).

BETWEEN	AND	° ′	″	Mean
Purteemalli	Permaul hill	57 57	29.	31.07″
			28.	
			31.	
			29.25	
			32.	
			33.	
			30.5	
			28.5	
			34.	
			35.5	
Permaul hill	Rissheemalli	47 45	25.5	30.5
			30.	
			31.5	
			35.	

At Rissheemalli.

Kurroomalli	Permaul hill	72 47	59.	60.42
			57.	
			59.5	
			64.5	
			61.5	
			62.	
	Referring flag	150 42	39.	38.28
			36.5	
			38.	
			37.5	
			37.	
			39.	
			38.5	
			39.	
			40.	
Referring flag	Nagamalli	42 46	30.	31.75
			28.5	
			34.	
			34.5	
	Suddragherry	4 40	14.	16.75
			16.	
			20.	
			17.	
			18.5	
			15.	

At Rissheemalli (continued).

BETWEEN	AND	°	′	″
Referring flag	Kurroomalli	150	42	38.28
Kurroomalli	Permaul hill	72	48	0.42
Referring flag	Permaul hill	77	54	37.86
Ditto	Suddragherry	4	40	16.75
Suddragherry	Permaul hill	82	34	54.61
Referring flag	Permaul hill	77	54	37.86
Ditto	Nagamalli	42	46	31.75
Nagamalli	Permaul hill	120	41	9.61
Referring flag	Suddragherry	4	40	16.75
Ditto	Nagamalli	42	46	31.75
Nagamalli	Suddragherry	38	6	15.

At Nagamalli.

Rissheemalli	Permaul hill	36	19	22.5 / 20. / 19. / 20.25 / 18.25 / 21.	20.17
	Suddragherry	120	33	24.5 / 22. / 23.5 / 23.5	23.38
Suddragherry	Sekundermalli	91	36	13.5 / 12. / 13.5 / 19.	14.5
Permaul hill	Rissheemalli	36	19	20.17	
Rissheemalli	Suddragherry	120	33	23.38	
Suddragherry	Permaul hill	84	14	3.21	

At Suddragherry.

BETWEEN	AND	°	′	″	Mean
Rissheemalli	Permaul hill	34	42	51.	
				50.25	
				52.5	
				49.75	56.64
				64.75	
				64.5	
				63.75	
Permaul hill	Nagamalli	56	3	29.5	
				30.25	
				32.25	
				12.5	22.34
				12.5	
				17.	
Rissheemalli	Nagamalli	21	20	22.25	
				23.5	
				25.5	
				23.	
				25	24.62
				26.5	
				27.25	
				24.	
Nagamalli	Sekundermalli	25	48	40 25	
				40.5	
				40.5	40.85
				41.5	
				41.5	
Sekundermalli	Gopaulswamy Station	54	1	28.65	
Referring flag	Meenachiporam hill ..	56	3	37.25	
				36.	
				33.5	35.56
				35.5	
	Perrioormalli	104	18	29.	
				33.	
				28.75	31.2
				31.25	
				34.	
Permaul hill	Rissheemalli	34	42	56.64	
Rissheemalli	Nagamalli	21	20	24.63	
Nagamalli	Permaul hill	56	3	21.27	
Ditto	Ditto (observed direct)	56	3	22.34	
	Mean......	56	3	21.8	

At Suddragherry (continued.)

BETWEEN	AND	°	′	″
Referring flag	Perrioormalli	104	18	31.2
	Meenachiporam hill	56	3	35.56
Meenachiporam hill	Perrioormalli	48	14	55.64

At Sekundermalli.

BETWEEN	AND	°	′	″	Mean ″
Nagamalli	Suddragherry	65	36	3.	8.63
				10.5	
				10.	
				11.	
Gopaulswamy	Suddragherry	20	4	44.5	49.8
				51.5	
				51.5	
				51.	
				51.5	
				48.5	
				50.	
	Kooteapâra	42	6	10.5	10.1
				11.	
				12.5	
				6.5	
				10.	
Kooteapâra	Suddragherry	62	10	62.	59.4
				63.	
				64.	
				55.	
				53.	

At Gopaulswamy.

BETWEEN	AND	°	′	″	Mean ″
Suddragherry	Sekundermalli	105	53	45.5	45.55
				47.5	
				42.75	
				49.	
				43.	

At Gopaulswamy (continued).

BETWEEN	AND	°	′	″	Mean ″
Sekundermalli	......Kooteapâra..........	79	22	15.5	15.36
				14.	
				15.	
				15.75	
				16.5	
				14.5	
				14.	
				15.5	
				17.5	
Kooteapâra	.........Meenachiporam	28	8	48.5	47.61
				51.5	
				47.5	
				46.5	
				45.5	
				46.5	
				47.	
				47.	
				48.5	
Kaulikautân	.......Meenachiporam......	51	52	19.	23.63
				21.	
				26.25	
				23.5	
				27.	
				25.	
Meenachiporam hill	..Perrioormalli	55	43	45.5	49.09
				50.5	
				51.75	
				49.	
				49.5	
				50.	
				46.	
				50.5	

At Kooteapâra.

BETWEEN	AND	°	′	″	Mean ″
Sekundermalli	......Gopaulswamy	58	31	35.5	38.28
				36.5	
				37.5	
				39.5	
				35.5	
				39.75	
				42.5	
				39.5	

At Kooteapâra (continued).

BETWEEN	AND	°	′	″	Mean
Gopaulswamy	......Suddragherry	1	50	46.	45″.
				46.5	
				45.5	
				43.5	
				44.5	
				44.5	
				44.5	
Gopaulswamy	......Kaulikautân	64	49	39.	36.5
				34.	
Kaulikautân	........Meenachiporam	58	46	28.5	30.67
				29.	
				34.5	
				30.7	
Gopaulswamy	......Meenachiporam	123	36	11.5	8.1
				3.5	
				7.5	
				8.5	
				9.5	
Meenachiporam hill	..Gopaulswamy	123	36	8.1	
Gopaulswamy	......Suddragherry	1	50	45.	
Suddragherry	........Meenachiporam	121	45	23.1	
Sekundermalli	......Gopaulswamy	58	31	38.28	
Gopaulswamy	......Suddragherry	1	50	45.	
Suddragherry	........Sekundermalli	60	22	23.28	

At Meenachiporam Hill.

BETWEEN	AND	°	′	″	Mean
Kooteapâra	..........Gopaulswamy	28	15	7.	6.82
				7.75	
				7.5	
				7.5	
				8.	
				3.5	
				6.5	

At Meenachiporam Hill.

BETWEEN	AND	° ′ ″		
Suddragherry	Kooteapâra	35 54 33.5	34. 38. 35. 37.5 33.5 37.	35.5
Perrioormalli	Kaulikautân	11 12 57.5	54. 58.	56.5
	Gopaulswamy	68 40 38.75	37. 36.	37.25
	Suddragherry	61 1 0.	5.5 10. 7.	5.63
	Kolanelloor Station	89 51 58.5	57.25 61. 61.5 57.5	59.15
Kaulikautân	Perrioormalli	11 12 56.5		
Perrioormalli	Gopaulswamy	68 40 37.25		
Gopaulswamy	Kaulikautân	57 27 40.75		
	Kooteapâra	28 15 6.82		
Kooteapâra	Kaulikautân	85 42 47.57		

At Kaulikautân.

Meenachiporam	Gopaulswamy	70 39 61.	58.5 60. 58.5	59.5
	Perrioormalli	127 22 30.5	32. 27. 27.	29.13

At Perrioormalli.

BETWEEN	AND	°	′	″	
Meenachiporam	Kaulikautân	41	24	43.5	
				43.5	
				43.25	38.79
				32.	
				36.	
				34.5	
	Gopaulswamy	55	35	35.25	
				37.	
				34.5	40.05
				45.5	
				48.	
	Suddragherry	70	44	7.5	
				9.	8.67
				9.5	
	Vullunkota hill	72	53	36.5	
				39.5	35.5
				31.	
Vullunkota	Meenachiporam	72	53	35.5	
Meenachiporam	Suddragherry	70	44	8.67	
Suddragherry	Vullunkota	143	37	44.17	

At Kolanelloor Hill.

Meenachiporam	Perrioormalli	59	36	6.5	
				9.	7.19
				7.25	
				6.	
Perrioormalli	Vullunkota	48	44	13.5	
				16.5	
				15.5	15.9
				16.5	
				17.5	
Vullunkota	Vullanaud hill	46	53	60.	
				59.	
				61.5	
				61.	
				56.	58.75
				58.5	
				57.	
				57.	

At Vullunkota Hill.

BETWEEN	AND	°	′	″	″
Perrioormalli	Kolanelloor hill	88	53	48.	
				47.5	48.38
				48.	
				50.	
Kolanelloor hill	Vullanaud hill	38	11	53.	
				50.	
				54.	52.6
				53.5	
				52.5	
Vullanaud hill	Kunnimapotha	70	48	22.5	
				22.	20.4
				19.5	
				17.5	

At Vullunkota.

Vullanaud hill	Coonatoor hill	46	20	18.25	
				13.	16.44
				18.5	
				16.	
Coonatoor hill	East end of the Base ..	47	27	36.5	
				32.5	32.25
				31.5	
				28.5	

At Vullanaud Hill.

Kolanelloor hill	Vullunkota..........	94	54	14.5	
				13.	12.13
				12.	
				9.	
Vullunkota..........	Kunnimapotha	57	50	33.5	
				31.5	
				49.	
				48.5	46.54
				51.	
				57.	
				55.25	

At Vullanaud Hill (continued).

BETWEEN	AND	°	′	″	Mean ″
Vullunkota.........	Coonatoor hill	24	4	23.	
Coonatoor hill	Taulaootpotha	37	2	32.5	29.17
				34.25	
				34.25	
				33.	
				20.5	
				20.5	
Kunnimapotha	Red hill station	49	24	34.5	39.6
				36.	
				44.	
				39.5	
				44.	

At Taulaootpotha.

BETWEEN	AND	°	′	″	Mean ″
Vullanaud hill	Coonatoor hill	80	23	41.	40.4
				44.	
				45.5	
				34.	
				37.5	
Coonatoor hill	Vullunkota hill	61	13	20.5	18.8
				18.5	
				13.	
				20.	
				19.5	
				20.5	
				19.5	
	W. end of the Base ..	45	19	25.5	25.3
				22.	
				26.5	
				26.	
				26.5	
Vullunkota.........	W. end of the Base ..	15	53	52.5	54.65
				53.	
				51.	
				53.5	
				52.	
				54.	
				52.5	
				57.5	
				60.5	
				60.	

At Taulaootpotha (continued).

BETWEEN	AND	°	′	″	″
W. end of the Base	..E. end of the Base....	73	9	36.	
				32.5	
				30.5	
				37.5	30.5
				35.5	
				21.	
				20.5	

At Coonatoor Hill.

Taulaootpotha	......Vullanaud hill	62	33	56.	
				56.	
				46.5	53.67
				52.5	
				55.5	
				55.5	
Vullanaud hill	......Vullunkota hill	109	35	26.5	
				23.	
				24.25	24.2
				21.5	
				25.75	
Vullunkota hill	......Taulaootpotha	47	1	30.5	
				27.5	
				32.75	30.75
				31.25	
				31.75	
Taulaootpotha	......W. end of the Base ..	41	14	28.5	
				28.5	30.
				31.5	
				31.5	
W. end of the Base....	E. end of the Base	54	18	14.	
				17.5	
				16.	
				18.5	16.5
				14.5	
				20.5	
				14.5	
E. end of the Base....	Vullunkota..........	60	5	16.	
				16.5	
				18.25	16.81
				16.5	

At the West End of the Base (Palamcottah).

BETWEEN	AND	°	′	″	Mean ″
Vullunkota..........	Taulaootpotha	110	52	49.5	45.1
				49.	
				48.	
				41.5	
				44.5	
				44.	
				44.	
				47.	
				45.	
				46.	
				42.5	
				40.	
Taulaootpotha	Coonatoor hill	93	26	9.	9.33
				9.5	
				9.5	
Coonatoor hill	E. end of the Base....	62	54	46.	42.4
				46.5	
				42.	
				38.5	
				39.	
E. end of the Base....	Taulaootpotha	30	31	38.	36.82
				32.	
				32.	
				34.	
				35.5	
				42.5	
				43.75	

At the East End of the Base.

BETWEEN	AND	°	′	″	Mean ″
Vullunkota..........	Coonatoor hill	72	27	14.	13.17
				15.5	
				10.	
Coonatoor hill	W. end of the Base....	62	46	70.5	60.63
				65.5	
				64.75	
				54.	
				54.5	
				54.5	

At the East End of the Base (continued).

BETWEEN	AND	°	′	″	Mean ″
W. end of the Base....	Taulaootpotha	76	18	52.5	53.4
				55.5	
				53.5	
				54.5	
				51.	

At Kunnimapotha.

Vullunkota..........	Vullanaud hill	51	20	53.	56.93
				50.5	
				53.	
				52.	
				63.5	
				64.	
				62.5	
Vullanaud hill	Red hill station	66	8	28.	28.07
				29.5	
				29.5	
				30.	
				25.5	
				27.	
				27.	
Red hill station	Koodunkolum station..	52	56	22.	17.17
				22.	
				22.5	
				13.	
				12.5	
				11.	

At Red Hill Station.

Vullanaud hill	Kunnimapotha	64	26	56.5	54.4
				54.5	
				52.5	
				53.	
				55.5	
Kunnimapotha	Koodunkolum	73	48	18.	19.4
				19.5	
				17.5	
				20.5	
				21.5	

At Red Hill Station (continued).

BETWEEN	AND	°	′	″	Mean ″
Kunnimapotha	Munpotha	48	11	40.	
				41.5	40.42
				39.75	
Munpotha	Koodunkolum	25	36	40.5	
				40.5	40.5
				40.5	

At Munpotha.

BETWEEN	AND	°	′	″	Mean ″
Kunnimapotha	Red hill Station	58	34	52.	
				49.	
				46.5	41.1
				30.5	
				27.5	
Red hill Station	Koodunkolum Station	62	30	28.	
				27.	
				31.5	
				33.5	37.33
				51.	
				53.	
Koodunkolum Station	Punnae Station	23	24	17.	
				19.5	
				17.5	
				17.	16.5
				16.5	
				15.	
				16.	
				13.5	
Kunnimapotha	Punnae Station	144	29	37.	
				35.5	
				40.5	
				33.	36.
				35.	
				36.5	
				34.5	

		°	′	″
Red hill Station	Koodunkolum	62	30	37.33
Koodunkolum	Punnae Station	23	24	16.5
Punnae Station	Red hill Station	85	54	53.83
Kunnimapotha	Punnae Station	144	29	36.
Ditto	Red hill Station	58	34	42.17
Ditto	Ditto (observed direct)			41.1
	Mean	58	34	41.64

At Koodunkolum Station.

BETWEEN	AND	°	′	″	Mean ″
Kunnimapotha	......Red hill Station	53	15	30.	28.13
				30.5	
				25.	
				27.	
Red hill Station......	Munpotha	91	52	48.5	43.13
				45.	
				37.5	
				41.5	
Munpotha	Punnae Station	59	7	22.	20.97
				21.	
				21.	
				19.5	
				16.	
				21.75	
				23.5	
				23.	
	Kunnimapotha	38	37	14.	15.5
				17.	
				19.5	
				12.5	
				14.5	
Punnae Station	Munpotha Station	59	7	20.97	
Munpotha Station....	Kunnimapotha	38	37	15.5	
Kunnimapotha	Punnae Station	97	44	36.47	

At Punnae Station.

BETWEEN	AND	°	′	″	Mean ″
Koodunkolum	Munpotha	97	28	28.	22.81
				28.	
				25.	
				22.	
				27.	
				26.5	
				12.	
				14.	

3. *Description of the great Stations.*

PURMUTTY or *Molapolliam* hill is about one and a half miles N.E. from the village of *Purmutty*, and about ten miles south from *Kodimoodi;* at the foot of the hill on the west side is a small village, *Molapolliam*, from whence the road (which is a causeway) leads to the summit of the hill, where there is a pagoda, on the platform of which is the station, marked by a small hollow in the *chunam*, about thirty feet S. West from the tower of the pagoda.

Shennimalli. A hill near a respectable village of that name, on the great road from *Erode* to *Daraporam*. The station is on the highest part of the hill, a few hundred feet N.W. from the pagoda. It is marked as usual with a platform and stone.

Yaëlmatoor Hill. A well-known hill, about six miles E.N.E. from *Shennimalli*, with a pagoda near the top. The station is on a stone platform, a little way to the N.W. of the pagoda, on the highest part of the hill.

Hallagamalli. A hill with a pagoda on the top, about seven miles S.W. from *Shennimalli*. The station is on the platform of the pagoda.

Oodoormalli. A hill near the village of *Oodoor*, on the great road to *Daraporam*, and about twenty miles S. by W. from *Shennimalli*. There is a small pagoda on the east part of the hill, but the station is considerably to the westward of the pagoda, upon a rock, which has a circle marked upon it.

Base. N.W. end. This is a rising ground near the village of *Putchapolliam*, about five miles east from *Kongiam*. It is marked by a circular platform, built of brick and *chunam*, with a marked stone in the middle, which marks the extremity, as in the other base lines. The S. E. extremity of the base lies near the village of *Kautpolliam*, and is marked in the same manner. Both these platforms have large stones at the bottom, fixed when the foundations were laid, and there are circles inserted, whose centres define the extremities of the line.

Putchapolliam station is the great station of observation for continuing the meridian line, and is marked by a larger platform of brick, and marked in a similar manner to the other. It is a little to the eastward of the Base line, and nearly a mile from the N. W. extremity. This station was chosen for the sole purpose of observing zenith distances, being only seven hundred feet west from the meridian of *Dodagoontah*, near *Bangalore*.

Naudkaunee Hill. A small hill about five miles S. W. from the S. E. end of the Base. The station is on a wall, which has been intended for a building.

Parteemalli will be found about six miles S.E. from *Daraporam*, with the village of *Parteeoor* almost at the north foot of the hill. The station is the centre of a large platform, marked on a stone by a circle.

Kurroomalli is a great mountain, about seventeen miles N. W. from *Dindigul*, and four miles east from *Yeddacottah*, in the *Coimbetoor*. The station is on the northern and highest part of the ridge, on a circular platform, marked by a large stone, with a circle and point on it.

Permaul Hill. This is a prominent point on the great mass of mountains south of *Pyney*, called the *Pyney*

mountains; and is called *Permaulmalli* by the inhabitants of the mountain only. There is no station on this hill, though it is used as one of the principal points in the series of triangles extending southerly; there has been a flag on the hill, and the place where it stood is marked by a platform of earth.

Rissheemalli is about twelve miles south from *Dindigul*, and five miles N.W. from *Ammanaigpettah*, a few miles to the westward of the great road leading to *Madura*. The road to the summit is on the east side of the hill, leading from the village of *Shulleeputty*. The station is on a circular platform (a few yards west of a stone pillar), and marked as usual.

Nagamalli Station. There is a well-known range of hills west of *Madura*, nearly on the south bank of the *Vyga* river, called *Nagamalli*; the station is on that part of the range that lies nearly south of *Sholavundan*, marked on the rock.

Suddragherry. This is a stupendous mountain, about fifteen miles north from *Shevilipootoor*. The road to the station is on the south side from *Koolapanaikputty*. The station will be found on a bare top, in the centre of a platform, marked by a circle inscribed on a stone, over which the stump of a tree is placed, supported by a pyramid of stones, to serve as a mark.

Sekundermalli. This is a well-known rock, five miles S.W. from *Madura*, and close on the great road leading to *Palamcottah*. There is a mosque on the summit of the rock; and the station is on the platform, nearly in the centre.

Gopaulswamy, a very remarkable rock, about five and a half miles S.E. from *Toomichinaikpettah*, on a rising ground, covered with jungle; it is a double rock, and has

a singular appearance at a distance; there is a pagoda on the western rock, and the station is on the top of the pagoda, between the tower and the S.E. corner.

Kooteapára station is on a rocky hill in the *Ramisseram* district, about six miles west from *Arupcota*, marked as usual on a rock.

Meenachiporam. This is a solid rock, about three and a half miles north from *Yettiaporam*, or *Etiapoor*, and nine miles east from *Kovilputty*; there is a small village called *Mullaputty* at the S.E. foot of the rock, and the village *Meenachiporam* (from which the name of the hill is derived) is about one mile north of the rock. The station is on a stone building on the rock, marked.

Kaulikaután. A hill with a pillar on the top, about three miles S.E. from *Kurroonelloor*; there is a platform about fifteen yards east from the pillar, and a marked stone in the middle of the platform defines the station.

Perrioormalli is three and a half miles N.W. from *Sungarnacoil*, in the *Tinnivelly* province; the road to the summit of the hill is on the east side, leading from a *choultry*. It is a three-topped hill, and the station is on the highest and easternmost top, where there is a platform marked as usual.

Kolanelloor station is on a beautiful rising ground, in the plains of *Panjalamkoorchee*, about three miles west from *Wotapadaram*. There is a place of worship on this little eminence, shaded by a cluster of trees; and the station will be found on a platform, a little to the north of the trees, marked as usual.

Vullunkota is a small hill, about seven miles N.W. from *Tinnivelly*, and about two miles S.W. from

Modakoorchi; the station will be found on a platform marked.

Vullanaud-Hill. This a conspicuous range, about ten miles east nearly from *Palamcottah*, and about one mile east from the village of *Vullanaud*. The station is on the highest peak (called *Womay's* peak), and is marked by a level spot with a stone, &c.

Taulaootpotha. This is nearly at the eastern extremity of the low range of hills that is seen about six miles north of *Palamcottah*, running east and west, whereof *Vullunkota* is the western extremity. There is a village about half a mile south of the hill, called *Tautaoot*, from whence the hill derives its name; the station is defined by a large stone marked as usual, and can be pointed out by the inhabitants, though there is no platform.

Coonatoorpotha is a small hill, about two miles S.W. from *Tinnivelly*, and nearly on the north bank of the *Tambrapurni* river. There are several villages near this hill, but the village from which it derives its name is on the east side of the hill. A small platform on the hill, marked as usual, defines the station.

Base Line, west end, is about a mile and a half west from the village of *Shadooroypootoor*, and about five miles N.W. from *Tinnivelly;* it is marked by a large stone with a circle. The east end is about one hundred and fifty yards west from the village of
and six miles N.E. from *Tinnivelly*, marked by a large stone.

Kunnimapotha. A small but steep hill, at the S.E. extremity of a range of hills that lies about two and a half miles nearly west from *Nagalancherry*, and about five miles east from *Calcaud.* The station is on a platform marked.

Red Hill Station. This station is on the red sand-hills, that lie about eight miles west from *Manapar*, and about two miles east from a small village called *Ittumpully*, whose inhabitants alone can trace the spot on the sand-hill where the station was, and which is marked by five very long pickets, driven into the drift sand, four of which form a square of nearly three feet, and the fifth, being in the centre of the square, defines the station.

Munpotha is a small rocky hill, about four miles east from *Arambully*, and three miles south from *Punnagoody*. The road to the summit is on the east side of the hill. The station is on a large rock marked by a circle.

Koodunkolum station is on a rising ground, about three miles S.W. from the village of that name, and three miles N.E. from *Pillikolum*. This ground is nearly a mile north from the sea-shore, and is covered with a thick forest of thorn-trees. The station will be found in the centre of a high circular platform marked on a stone.

Punnae station is the great station of observation at the southern extremity of the grand meridional arc, and is marked by a square building with two doors and two windows arched, and a solid pillar in the middle, on the top of which there is a large circular stone, with a hole in the centre. The building is on a rising ground, nearly a mile S.E. from the village of *Punnae*, about eight miles N.E. from *Cape Comorin*, and nearly seven hundred yards from the sea-shore.

4. *Principal Triangles.*

N.W. end of the Base from S.E. end of the Base 32301.28 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
1	N.W. end of the Base	46° 18′ 22.12″				46° 18′ 22.25″	
	S.E. end of the Base..	77 29 12				77 29 12	
	Naudkaunee hill	56 12 25.67				56 12 25.75	
		179 59 59.79				180 0 0.	
	Naudkaunee hill from N.W. end of the Base......						37944.6
	Naudkaunee hill from S.E. end of the Base......						28103.1
2	N.W. end of the Base	87 3 53.7	−0.19″			87 3 53	
	S. E. end of the Base...	61 23 47.4	−0.11			61 23 47	
	Oodoormalli	31 32 20.75	−0.11			31 32 20	
		180 0 1.85		0.41″	+ 1.44″	180 0 0.	
	Oodoormalli from N.W. end of the Base.........						54215.7
	Oodoormalli from S.E. end of the Base						61671.1
3	N.W. end of the Base	142 32 41.25	−0.77			142 32 40.75	
	S.E. end of the Base..	. . .				24 53 31.8	
	Hallagamalli	. . .				12 33 47.45	
						180 0 0.	
	Hallagamalli from N.W. end of the Base						62505.7
	Hallagamalli from S.E. end of the Base						90309.6

N.W. end of the Base from Naudkaunee hill 37944.6

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
4	N.W. end of the Base	40 45 31.25				40 45 31	
	Naudkaunee	95 2 15.67				95 2 15	
	Oodoormalli	44 12 14.06				44 12 14	
		180 0 0.98				180 0 0.	
	Oodoormalli from N.W. end of the Base						54212.9
	Oodoormalli from Naudkaunne hill						35531.4

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	N.W. end of the Base from Oodoormalli 54214.3 Feet.						
		° ′ ″	″			° ′ ″	
5	N.W. end of the Base	55 28 47.55	—0.21			55 28 45.75	
	Oodoormalli	69 57 13.08	—0.24			69 57 11.25	
	Hallagamalli	54 34 4.67	—0.21			54 34 3.	
		180 0 5.3		″ 0.66	″ + 4.64	180 0 0.	
	Hallagamalli from { N.W. end of the Base						62505.7
	Hallagamalli from { Oodoormalli						54821.3
	The above Base is the mean distance obtained by the triangles N. W. and S. E. end of the Base, and *Oodoormalli*, and N W. end of the Base, *Naudkaunee* hill, and *Oodoormalli*.						
	S.E. end of the Base from Oodoormalli, 61671.1						
6	S.E. end of the Base..	36 30 15.3	—0.15			36 30 14.75	
	Oodoormalli	101 29 33.08	—0.49			101 29 32.	
	Haliagamalli	42 0 13.92	—0.14			42 0 13.25	
		180 0 2.3		″ 0.78	″ + 1.52	180 0 0.	
	Hallagamalli from { S.E. end of the Base						90312.2
	Hallagamalli from { Oodoormalli						54824.1
	N.W. end of the Base from Hallagamalli 62505.7						
7	N.W. end of the Base	77 17 15.65	—0.33			77 17 14.5	
	Hallagamalli	47 48 23.25	—0.23			47 48 22.5	
	Shennimalli..........	54 54 23.83	—0.25			54 54 23.	
		180 0 2.73		″ 0.81	″ + 1.92	180 0 0.	
	Shennimalli from { N.W. end of the Base						56597.8
	Shennimalli from { Hallagamalli						74520.2
	Hallagamalli from Shennimalli 74520.2						
8	Hallagamalli	60 22 13.25	—0.45			60 22 12.	
	Shennimalli..........	69 10 0.93	—0.51			69 9 59.5	
	S.E. end of the Base ..	50 27 49.94	—0.42			50 27 48.5	
		180 0 4.02		″ 1.38	″ + 2.64	180 0 0.	
	S.E. end of the Base from { Hallagamalli						90808.9
	S.E. end of the Base from { Shennimalli.............						83991.3

Shennimalli from S.E. end of the Base 83991.3 Feet

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
9	Shennimalli	82 1 30	−0.51			82 1 31.5	
	S.E. end of the Base..	38 16 39.75	−0.32			38 16 41.	
	Yaëlmatoor hill	59 41 45.58	−0.35			59 41 47.5	
		179 59 55.33		″ 1.18	″ −5.85	180 0 0.	
	Yaëlmatoor hill from { Shennimalli						60265.1
	{ S.E. end of the Base						96342.9

Hallagamalli from S.E. end of the Base 90310.2

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
10	Hallagamalli	47 31 21.37	−0.52			47 31 21.	
	S.E. end of the Base..	88 44 30.92	−1.0			88 44 30.25	
	Yaëlmatoor hill	43 44 9.07	−0.53			43 44 8.75	
		180 0 1.36		″ 2.05	″ −0.69	180 0 0.	
	Yaëlmatoor hill from { Hallagamalli						103600.5
	{ S.E. end of the Base						96346.5

The above Base is the mean distance obtained in the three triangles on the Bases, N.W. end of the Base from S.E. end of the Base; S.E. end of the Base from Oodoormalli; and Hallagamalli from Shennimalli.

Shennimalli from Yaëlmatoor hill 60265.1.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
11	Shennimalli	92 57 35.69	″ −0.45			92 57 35.5	
	Yaëlmatoor hill	43 23 23.25	−0.20			43 23 23.25	
	Putchapolliam Station	43 39 1.19	−0.20			43 39 1.25	
		180 0 0.13		″ 0.85	−0.72	180 0 0.	
	Putchapolliam Station from { Shennimalli						59977.2
	{ Yaëlmatoor hill						87191.9

Yaëlmatoor hill from S.E. end of the Base 96344.75.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
12	Yaëlmatoor hill	16 18 22.33	″ −0.13			16 18 24.	
	S.E. end of the Base ..	62 39 27.25	−0.04			62 39 27.5	
	Putchapolliam Station	101 2 8.73	−0.39			101 2 8.5	
		179 59 58.31		″ 0.56	″ −2.25	180 0 0.	
	Putchapolliam Station from { Yaëlmatoor hill						87193.3
	{ S.E. end of the Base ...						27561.2

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Yaëlmatoor hill from S.E. end of the Base = 96344.7 Feet.						
		° ′ ″				° ′ ″	
13	Yaëlmatoor hill ……	. . .				51 59 20.	
	S.E. end of the Base..	67 51 1.67	−0.67			67 51 1.	
	Parmatty hill ……	60 9 39.75	−0.61			60 9 39.	
						180 0 0.	
	Parmatty hill from Yaëlmatoor hill ……						102873.
	Parmatty hill from S.E. end of the Base ……						87510.9
	Hallagamalli from Yaëlmatoor hill = 130600.5.						
14	Hallagamalli ……	36 0 10.75	−0.72			36 0 10.	
	Yaëlmatoor hill ……	. . .				95 43 40.	
	Parmatty hill ……	48 16 10.75	−0.67			48 16 10.	
						180 0 0.	
	Parmatty hill from Hallagamalli ……						174127.5
	Parmatty hill from Yaëlmatoor hill ……						102870.
	Hallagamalli from Parmatty hill = 174127.5.						
15	Hallagamalli ……	63 49 38.4	″ −1.70			63 49 36.5	
	Parmatty hill ……	. . .				46 44 49.5	
	Parteemalli ……	69 25 35.75	−1.84			69 25 34.	
						180 0 0.	
	Parteemalli from Hallagamalli ……						135463.2
	Parteemalli from Parmatty hill ……						166919.4
	Hallagamalli from S.E. end of the Base = 90310.2.						
16	Hallagamalli ……	52 18 34.42	−0.62			52 18 33.8	
	S.E. end of the Base…	86 0 14.12	−1.07			86 0 13 4	
	Parteemalli ……	41 41 13.	−0.61			41 41 12.8	
		180 0 1.54		″ 2.30	−0.76	180 0 0.	
	Parteemalli from Hallagamalli ……						135462.6
	Parteemalli from S.E. end of the Base ……						107456.0

Number	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	S.E. end of the Base from Parmatty hill = 87510.9.						
		° ′ ″	″			° ′ ″	
17	S.E. end of the Base...	117 24 22.42	−1.85			117 24 20.5	
	Parmatty hill...........	. . .				34 51 18.5	
	Parteemalli..............	27 44 21.17	−0.13			27 44 21.	
						180 0 0.	
	Parteemalli from S.E. end of the Base						107451.
	Parteemalli from Parmatty hill..						166913.7
	S. E. end of the Base from Parmatty hill = 87510.9 Feet.						
18	S.E. end of the Base ...	58 53 34.25	−0.71			58 53 33.5	
	Parmatty hill	81 54 58.67	−1.06			81 54 57.5	
	Rungamalli	. . .				39 11 29.	
						180 0 0.	
	Rungamalli from S.E. end of the Base						137109.5
	Rungamalli from Parmatty hill						118571.5
	Parmatty hill from Parteemalli = 166916.55.						
19	Parmatty hill	. . .				41 2 59.6	
	Parteemalli..............	56 39 10.88	−1.05			56 39 9.3	
	Kurroomalli	82 17 52.71	−1.6			82 17 51.1	
						180 0 0.	
	Kurroomalli from Parmatty hill						140703.7
	Kurroomalli from Parteemalli						110614.8
	The distance from Parmatty to Parteemalli, as a base in the above triangle, is a mean distance obtained by the 15th and 17th triangles.						
	S.E. end of the Base from Parteemalli = 107453.5.						
20	S.E. end of the Base..	58 30 48.17	−0.95			58 30 47.2	
	Parteemalli.............	72 57 51.38	−1.15			72 57 50.2	
	Rungamalli.....	. . .				48 31 22.6	
						180 0 0.	
	Rungamalli from S.E. end of the Base						137127.1
	Rungamalli from Parteemalli						122303.1

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
21	S.E. end of the Buse...	. . .				48 43 20.1	
	Parteemalli..	84 23 29.13	−1.28			84 23 27.9	
	Kurroomalli	46 53 12.8	−0.76			46 53 12.	
						180 0 0.	
	Kurroomalli from { S.E. end of the Base						146491.2
	Kurroomalli from { Parteemalli						110620.8

S.E. end of the Base from Parteemalli is a mean distance derived from the 16th and 17th triangles as a base.

Parteemalli from Rungamalli = 122303.1 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
22	Parteemalli..............	11 25 35.8	−0.12			11 25 35.7	
	Rungamalli...............	. . .				57 39 47.5	
	Kurroomalli	110 54 37.44	−0.66			110 54 36.8	
						180 0 0.	
	Kurroomalli from { Parteemalli						110621.6
	Kurroomalli from { Rungamalli						25938.0

Parteemalli from Kurroomalli = 110619.0.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
23	Parteemalli...............	77 20 49.21	−1.39			77 20 47.8	
	Kurroomalli	57 57 31.07	−1.05			57 57 30.	
	Permaul hill	. . .				44 41 42.2	
						180 0 0.	
	Permaul hill from { Parteemalli						133318.9
	Permaul hill from { Kurroomalli.................						153458.5

The above Base, Parteemalli from Kurroomalli, is the mean distance, determined by the 19th and 22d triangles.

Kurroomalli from Permaul hill = 153458.5.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
24	Kurroomalli	47 45 30.5	−1.11			47 45 29.5	
	Permaul hill	. . .				59 26 31.5	
	Rissheemalli	72 48 0.42	−1.43			72 47 59.	
						180 0 0.	
	Rissheemalli from { Kurroomalli.................						138332.1
	Rissheemalli from { Permaul hill						118926.2

Permaul hill from Rissheemalli = 118926.2.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
25	Permaul hill	. . .				22 59 32.	
	Rissheemalli	120 41 9.61	—2.0			120 41 7.6	
	Nagamalli	36 19 20.17	+0.19			36 19 20.4	
						180 0 0.	
	Nagamalli from Permaul hill						172665.4
	Nagamalli from Rissheemalli						78425.1
26	Permaul hill	. . .				62 42 12.4	
	Rissheemalli	82 34 54.61	—2.27			82 34 52.3	
	Suddragherry	34 42 56.64	—1.39			34 42 55.3	
						180 0 0.	
	Suddragherry from Permaul hill						207077.6
	Suddragherry from Rissheemalli						185571.9

Permaul hill from Nagamalli = 172665.4 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
27	Permaul hill	. . .				39 42 38.9	
	Nagamalli	84 14 3.21	—2.45			84 14 0.8	
	Suddragherry	56 3 21.8	—1.52			56 3 20.3	
						180 0 0.	
	Suddragherry from Permaul hill						207082.6
	Suddragherry from Nagamalli						132980.6

Suddragherry from Rissheemalli = 185571.9.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
28	Suddragherry	21 20 24.63	—0.13			21 20 24.5	
	Rissheemalli	38 6 15.	+0.29			38 6 14.5	
	Nagamalli	120 33 23.38	—2.28			120 33 21.	
		180 0 3.01		″ 2.13	″ +0.88	180 0 0.	
	Nagamalli from Suddragherry						132981.4
	Nagamalli from Rissheemalli						78420.2

Suddragherry from Nagamalli = 132981.							
Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
29	Suddragherry	25 48 40.85	−0.51			25 48 38.5	
	Nagamalli	91 36 14.5	−1.07			91 36 13.5	
	Sekundermalli	62 35 8.63	−0.43			62 35 8.	
		180 0 3.98		″ 2.06	″ −1.92	180 0 0.	
	Sekundermalli from { Suddragherry						149745.
	Sekundermalli from { Nagamalli						64224.

Suddragherry, from Nagamalli as a Base in the last triangle, is a mean distance derived from the 27th and 28th triangles.

Measurement of the Base Line near Pallamcottah.

Experiments made for comparing the Chains.

PREVIOUS TO THE MEASUREMENT.			AFTER THE MEASUREMENT.		
1809.	Excess of the Old Chain.	REMARKS.	1809.	Excess of the Old Chain.	REMARKS.
Month.	Divisions.		Month.	Divisions.	
February 27th	30.		March 20th	39.	
P. M.	29.		A. M.	39.5	
	31.5			39.	
	29.	The mean		40.	The mean
	29.			39.	
	29.	temperature		39.	temperature
	29.			39.	
	29.	during these		39.	during these
	29.5			39.	
28th	29.75	experiments		38.5	experiments
A. M.	30.5			38.5	
	30.5	was 83°.24.		39.	was 79°.13.
	29.			39.	
	30.5				
Mean	29.66		Mean	39.04	

TABLE containing the Particulars of the Measurement.

[Commenced on the 28th February, 1809.]

No. of the Hypothenuse.	Length of each in Feet.	Angles of Elevations and Depressions.			Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.
						Ascents.	Descents.	Above.	Below.	
		°	′	″	Feet.	Feet.	Feet.	Inches	Inches	°
1	500	0	11	54	.00300		1.73	30.7		97.88
2	600	0	11	30	.00336	2.01		3.6		80.03
3	400	0	30	0	.01524	3.49		8.0		96.15
4	100	0	13	18	.00075		0.39		12.5	106.2
5	100	0	22	15	.00210	0.65		5.8		112.6
6	600	0	27	0	.01848	4.71		16.0		76.67
7	600	Level.							2.8	100.13
8	500	0	13	55	.00405	2.02		6.8		100.8
9	500	0	21	22	.00970	3.11		5.		91.6
10	500	0	7	15	.00110		1.05			94.52
11	400	0	32	36	.01800	3.79		21.		87.6
12	700	0	13	57	.00560	2.84			2.1	97.8
13	700	0	5	21	.00084	1.09				85.1
14	700	0	5	51	.00098	1.19			3.3	109.2
15	700	0	16	37	.00812	3.38			3.	82.3
16	600	0	18	3	.00828	3.15			7.5	106.4
17	700	0	6	42	.00133	1.36			2.0	96.3
18	600	0	12	48	.00420	2.24			8.8	83.3
19	500	0	19	3	.00770	2.77			5.9	99.2
20	700	Level.							6.5	91.4
21	400	0	2	30	.00012		0.29			78.8
22	700	0	2	30	.00021		0.51	3.8		96.5
23	600	0	12	21	.00390	2.16		6.2		105.5
24	700	0	13	39	.00553	2.78			1.1	81.
25	800	0	2	48	.00032	0.65			9.2	86.1
26	700	0	15	48	.00735	3.22		4.2		108.4
27	600	0	3	18	.00030	0.58			2.	83.7
28	€00	0	26	57	.01842	4.7		4.0		87.3
29	900	0	15	30	.00913	4.06			2.5	109.2
30	500	0	22	12	.01045	3.23			0.5	84.3
31	700	0	9	24	.00259	1.91			7.2	94.
32	700	0	22	7	.01449	4.50			5.6	100.8
33	500	0	20	0	.00845	2.91				76.0
34	700	0	5	39	.00098		1.15		8.5	81.9
35	600	0	11	39	.00345	2.03		2.3		97.9
36	700	0	12	48	.00490	2.61			0.6	92.1
37	700	0	21	4	.01316	4.29		4.5		79.9
38	900	0	13	30	.00697	3.53			17.7	100.5
39	800	0	34	42	.04072	8.08		14.8		87.9
40	700	0	27	48	.02289	5.66		2.5		85.8
41	800	0	5	42	.00112	1.33			8.6	96.9
42	1000	0	5	30	.00130	1.60			2.8	81.8
43	700	0	17	30	.00906	3.56		10.5		93.9
44	1200	0	28	21	.04080	9.90		3.25		88.9
45	1100	0	10	0	.00462	3.20		0.3		89.7
46	900	0	11	45	.00526	3.08			5.35	98.
47	600	0	13	39	.00474	2.38			2.2	104.5
Descent from the termination of the Base to the ground.									32.0	
	30500				.35406	119.75	5.12	153.25	160.25	92.9

[Completed on the 18th March, 1809.]

West end of the Base, above the East end of the Base, in perpendicular height 114.05 Feet.

	Feet.
At the commencement, the old chain exceeded the new one 29.66 divisions of the micrometer, equal to .01188 feet. Therefore 305×100.01188 feet, will be the measure in terms of the new chain. .	$=30503.6243$
At the conclusion, the old chain exceeded the new one 39.04 divisions, and had therefore increased 9.38 divisions, equal to .00376 feet. Hence $305 \times \frac{.00376}{2}$ $=0.5731$ feet, the correction for the wear, which add.	+ 0.5731
The sum of the deductions from col. 4th is 0.35406 feet, which being increased in the ratio of 100 to 100.01188 will be .3541 feet, which subtract	— 0.3541
Hence the apparent horizontal distance will be	30503.8433
The correction for the expansion and reduced to the standard temperature of 62°, will be $\frac{(92^\circ.9-50^\circ)\times.0074-(62^\circ-50^\circ)\times.01237}{12}$ $\times 30503.8433$ feet, which add	+ 4.2965
Hence, the corrected measure of the Base, for the temperature of 62°, will be	30508.1398
Which being reduced to the level of the sea, by taking the mean height of the Base, and which is 435.86 feet above the level of the sea, will be.	30507.5

The triangles have been brought down from *Suddragherry* and *Sekundermalli*, for the purpose of ascertaining the height of this Base above the Sea, which was necessary to reduce it. After the reduction, the triangles commenced at this Base, and have been carried back in the following order, to bring out the same distance *Suddragherry* from *Sekundermalli*.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	West end of the Base from East end of the Base = 30507.5 Feet.						
		° ′ ″	″			° ′ ″	
30	W. end of the Base ..	62 54 42.4	−0.07			62 54 42.	
	E. end of the Base	62 47 0.63	−0.07			62 47 1.	
	Coonatoor hill	54 18 16.5	−0.07			54 18 17.	
		179 59 59.53		″ 0.21	″ −0.68	180 0 0.	
	Coonatoor hill from W. end of the Base						33405.8
	Coonatoor hill from E. end of the Base						33444.1
31	W. end of the Base ..	30 31 36.82				30 31 36.	
	E. end of the Base	76 18 53.4				76 18 53.	
	Taulaootpotha	73 9 30.5				73 9 31.	
		180 0 0.72				180 0 0.	
	Taulaootpotha from W. end of the Base						30969.7
	Taulaootpotha from E. end of the Base						16190.35
	W. end of the Base from Taulaootpotha = 30969.7.						
32	W. end of the Base	110 52 45.1				110 52 45.	
	Taulaootpotha	15 53 54.65				15 53 54.5	
	Vullunkotapotha	. . .				53 13 20.5	
						180 0 0.	
	Vullunkota from W. end of the Base						10591.7
	Vullunkota from Taulaootpotha						36126.4
	E. end of the Base from Coonatoor hill = 33444.1.						
33	E. end of the Base	72 27 13.17	−0.11			72 27 12.5	
	Coonatoor hill	60 5 16.81	−0.08			60 5 16.	
	Vullunkota	47 27 32.25	−0.11			47 27 31.5	
		180 0 2.23		″ 0.30	″ +1.93	180 0 0.	
	Vullunkotapotha from E. end of the Base						39345.
	Vullunkotapotha from Coonatoor hill						43279.6

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	W. end of the Base from Coonatoor hill=33405.8 Feet.						
		° ′ ″	″			° ′ ″	
34	W. end of the Base ...	93 26 9.33	−0.11			93 26 7.7	
	Coonatoor hill............	41 14 30.	−0.06			41 14 28.5	
	Taulaootpotha	45 19 25.3	−0.06			45 19 23.8	
		180 0 4.63		″ 0.23	″ +4.43	180 0 0.	
	Taulaootpotha from W. end of the Base						30969.7
	Taulaootpotha from Coonatoor hill.....................						46894.2
	Coonatoor hill from Vullunkota=43279.6.						
35	Coonatoor hill	47 1 30.75	−0.11			47 1 30.6	
	Vullunkota	. . .				71 45 10.7	
	Taulaootpotha	61 13 18.8	−0.11			61 13 18.7	
						180 0 0.	
	Taulaootpotha from Coonatoor hill..............						46895.3
	Taulaootpotha from Vullunkota						36127.8
	Vullunkota from Taulaootpotha=36126.4.						
36	Vullunkota	. . .				71 45 10.7	
	Taulaootpotha	61 13 18.8	−0.11			61 13 18.7	
	Coonatoor hill...........	47 1 30.75	−0.11			47 1 30.6	
						180 0 0.	
	Coonatoor hill from Vullunkota						43278.
	Coonatoor hill from Taulaootpotha						46893.6
	Coonatoor hill from Taulaootpotha=46894.33.						
37	Coonatoor hill............	62 33 53.67	−0.23			62 33 52.6	
	Taulaootpotha	80 23 40.4	−0.32			80 23 39.3	
	Vullanaud hill...........	37 2 29.17	−0.21			37 2 28.1	
		180 0 3.24		″ 0.76	″ +2.48	180 0 0.	
	Vullanaud hill from Coonatoor hill..............						76755.9
	Vullanaud hill from Taulaootpotha..............						69092.0

The distance, Coonatoor hill from Taulaootpotha as a Base in the above triangle, is the mean deduced from the 34th, 35th, and 36th triangles.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Coonatoor hill from Vullanaud hill=76755.9.						
38	Coonatoor hill..........	° ′ ″ 109 35 24.2	″ −0.58			° ′ ″ 109 35 22.7	
	Vullanaud hill..........	24 4 23.	−0.11			24 4 21.9	
	Vullunkota..............	46 20 16.44	−0.05			46 20 15.4	
		180 0 3.64		″ 0.74	″ +2.90	180 0 0.	
	Vullunkota from Coonatoor hill.................						43278.4
	Vullunkota from Vullanaud hill						99960.0
	Vullanaud hill from Vullunkota=99960 Feet.						
39	Vullanaud hill........	94 54 12.13	−1.10			94 54 10.7	
	Vullunkota hill	38 11 52.6	−0.46			38 11 51.6	
	Kolanelloor hill	46 53 58.75	−0.45			46 53 57.7	
		180 0 3.48		2.01	+1.47	180 0 0.	
	Kolanelloor hill from Vullanaud hill						84657.3
	Kolanelloor hill from Vullunkota						136401.6
	Vullunkota from Kolanelloor=136401.6.						
40	Vullunkota	88 53 48.4	−2.4			88 53 46.	
	Kolanelloor hill	48 44 15.9	−1.26			48 44 14.6	
	Perrioormalli	. . .				42 21 59.4	
						180 0 0.	
	Perrioormalli from Vullunkota						152154.4
	Perrioormalli from Kolanelloor						202377.5
	Kolanelloor from Perrioormalli=202377.5.						
41	Kolanelloor.........	59 36 7.19	−1.07			59 36 6.1	
	Perrioormalli	. . .				30 31 56.9	
	Meenachiporam hill ..	89 51 59.15	−2.13			89 51 57.	
						180 0 0.	
	Meenachiporam from Kolanelloor hill						102813.5
	Meenachiporam from Perrioormalli						174556.9

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Perrioormalli from Meenachiporam = 174556.9.						
		° ′ ″	″			° ′ ″	
42	Perrioormalli	70 44 8.67	−2.99			70 44 5.7	
	Meenachiporam hill ..	61 1 5.63	−2.62			61 1 3.	
	Suddragherry	48 14 55.64	−2.4			48 14 51.3	
		180 0 9.94		″ 8.01	″ + 1.93	180 0 0.	
	Suddragherry from Perrioormalli						204679.3
	Suddragherry from Meenachiporam hill						220878.85
43	Perrioormalli	55 35 40.05	−2.13			55 35 38.	
	Meenachiporam	68 40 37.25	−2.47			68 40 35.	
	Gopaulswamy	55 43 49.09	−2.14			55 43 47.	
		180 0 6.39		″ 6.74	″ −1.35	180 0 0.	
	Gopaulswamy from Perrioormalli						196767.8
	Gopaulswamy from Meenachiporam						174274.5
	Perrioormalli from Meenachiporam hill = 174556.9 Feet.						
44	Perrioormalli	41 24 38.79	+ 0.83			41 24 38.5	
	Meenachiporam	11 12 56.5	−0.04			11 12 55.5	
	Kaulikautân	127 22 29.13	−1.96			127 22 26.	
		180 0 4.42		″ 1.17	″ + 3.25	180 0 0.	
	Kaulikautân from Perrioormalli						42722.3
	Kaulikautân from Meenachiporam hill						145290.4
	Meenachiporam hill from Kaulikautân = 145290.4.						
45	Meenachiporam hill ..	85 42 47.57	−1.57			85 42 46.	
	Kaulikautân hill	. . .				35 30 41.25	
	Kooteapâra	58 46 30.67	−0.95			58 46 29.75	
						180 0 0.	
	Kooteapâra from Meenachiporam hill						98692.8
	Kooteapâra from Kaulikautân hill						169427.5

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
	Meenachiporam	57 27 40.75	−1.61			57 27 39.7	
	Kaulikautân	70 39 59.5	−1.9			70 39 58.2	
	Gopaulswamy	51 52 23.63	−1.56			51 52 22.1	
46							
		180 0 3.88		″ 5.07	″ −1.19	180 0 0.	
	Gopaulswamy hill from Meenachiporam hill						174281.
	Gopaulswamy hill from Kaulikautân hill						155704.3

Meenachiporam from Gopaulswamy hill = 174277.5.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Meenachiporam hill	28 15 6.82	+0.12			28 15 6.8	
	Gopaulswamy hill	28 8 47.61	+0.12			28 8 47.5	
	Kooteapâra	123 36 8.1	−2.17			123 36 5.7	
47							
		180 0 2.53		″ 1.93	″ +0.60	180 0 0.	
	Kooteapâra from Meenachiporam hill						98704.7
	Kooteapâra from Gopaulswamy hill						99043.8

By referring to the 43d and 46th triangles, the distance Meenachiporam from Gopaulswamy will be found common to both, the mean of which is assumed as the Base in the above triangle.

Meenachiporam from Suddragherry = 220878.85.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Meenachiporam	35 54 35.5	+0.38			35 54 35.9	
	Suddragherry	. . .				22 20 4.3	
	Kooteapâra	121 45 23.1	−3.32			121 45 19.8	
48							
						180 0 0.	
	Kooteapâra from Meenachiporam hill						98714.35
	Kooteapâra from Suddragherry						152355.8

Kaulikautân from Kooteapâra = 169427.5 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Kaulikautân	. . .				35 9 13.4	
	Kooteapâra	64 49 36.5	−1.11			64 49 35.4	
	Gopaulswamy	80 1 12.71	−1.5			80 1 11.2	
49							
						180 0 0.	
	Gopaulswamy from Kaulikautân						155691.9
	Gopaulswamy from Kooteapâra						99050.5

Kooteapâra from Gopaulswamy = 99047.15.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
50	Kooteapâra..............	58 31 38.28	−0.88			58 31 37.4	
	Gopaulswamy...........	79 22 15.36	−1.22			79 22 14.1	
	Sekundermalli	42 6 10.1	−0.81			42 6 8.5	
		180 0 3.74		″ 2.91	″ +0.83	180 0 0.	
	Sekundermalli from Kooteapâra						145195.8
	Sekundermalli from Gopaulswamy						125997.6

The above Base, Kooteapâra from Gopaulswamy, is the mean obtained by the 47th and 49th triangles.

Suddragherry from Kooteapâra = 152355.8.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
51	Suddragherry	. . .				57 26 40.4	
	Kooteapâra..............	60 22 23.28	−1.56			60 22 21.7	
	Sekundermalli...........	62 10 59.4	−1.53			62 10 57.9	
						180 0 0.	
	Sekundermalli from Suddragherry						149740.7
	Sekundermalli from Kooteapâra						145195.

Sekundermalli from Gopaulswamy = 125997.6.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
52	Sekundermalli...........	20 4 49.8	−0.31			20 4 49.5	
	Gopaulswamy...........	105 53 45.55	−1.15			105 53 44.5	
	Suddragherry	54 1 28 65	−0.08			54 1 26.	
		180 0 4.		1.54	+2.46	180 0 0.	
	Suddragherry from Sekundermalli						149741.
	Suddragherry from Gopaulswamy						53455.9

In the two last triangles, the distance *Sekundermalli* from *Suddragherry* will be found common: then, by taking the mean and referring to the 29th triangle, it will appear, that there is a difference of $4\frac{1}{10}$ feet, in the same side *Suddragherry* from *Sekundermalli*; from whence it may be inferred, that had the base been computed from bringing down the triangles from the northward, it would have exceeded the measurement by 10 inches nearly.

Triangles continued to the South Extremity of the Arc.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Vullanaud hill from Vullankotapotha = 99960 Feet.						
		° ′ ″	″			° ′ ″	
	Vullanaud hill........	57 50 46.54	−0.77			57 50 45.3	
	Vullunkota	70 48 20.4	−0.92			70 48 19.	
	Kunnimapotha	51 20 56.93	−0.74			51 20 55.7	
53		180 0 3.87		″ 2.43	″ + 1.44	180 0 0.	
	Kunnimapotha from { Vullanaud hill						120880.1
	{ Vullunkota						108363.9
	Vullanaud hill from Kunnimapotha = 120880.1.						
	Vullanaud hill........	49 24 39.6	−0.81			49 24 39.	
	Kunnimapotha	66 8 28.07	−0.94			66 8 27.3	
	Red hill Station	64 26 54.4	−0.92			64 26 53.7	
54		180 0 2.07		2.67	−0.60	180 0 0.	
	Red hill Station from { Vullanaud hill						122534.5
	{ Kunnimapotha.............						101747.0
	Kunnimapotha from Red hill Station = 101747.						
	Kunnimapotha	52 56 17.17	−0.71			52 56 15.3	
	Red hill Station	73 48 19.4	−0.92			73 48 18.4	
	Koodunkolum	53 15 28.13	−0.72			53 15 26.3	
55		180 0 4.7		″ 2.35	+ 2.35	180 0 0.	
	Koodunkolum Station from { Kunnimapotha........						121934.1
	{ Red hill Station						101321.5
	Kunnimapotha from Red hill Station = 101747 Feet.						
	Kunnimapotha	. . .				73 13 39.2	
	Red hill Station.........	48 11 40.42	−0.6			48 11 39.8	
	Munpotha	58 34 41.64	−0.66			58 34 41.	
56						180 0 0.	
	Munpotha from { Kunnimapotha						88877.
	{ Red hill Station						114159.9

Red hill Station from Koodunkolum=101321.5.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
	Red hill Station	25 36 40.5	—0.2[illegible]			25 36 40.3	
	Koodunkolum........	91 52 43.13	—0.6[illegible]			91 52 42.6	
	Munpotha	62 30 37.33	—0.28			62 30 37.1	
57		180 0 0.96		1.19	−0.23	180 0 0.0	
	Munpotha from { Red hill Station						114155.95
	Munpotha from { Koodunkolum................						49371.8

Koodunkolum from Munpotha=49371.8.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Koodunkolum........	59 7 20.97	—0.04			59 7 21.	
	Munpotha	23 24 16.5	—0.05			23 24 16.5	
	Punnae Station	97 28 22.81	—0.12			97 28 22.5	
58		180 0 0.28		0.21	+ 0.07	180 0 0.	
	Punnae Station from { Koodunkolum						19779.5
	Punnae Station from { Munpotha						42737.9

For the purpose of reducing the terrestrial arc, the following angles, with their including sides, have been used, to obtain sides more conveniently situated with the meridian of *Dodagoontah* station, to which the whole Arc is reduced.

The angle at the South East end of the base, between *Parteemalli* and *Putchapolliam* station, corrected for the chords, equal 112° 5′ 9″.2 with the including sides, *Parteemalli* from S. E. end of the base, equal 107454.5 feet, and S.E. end of the base from *Putchapolliam*, =27561.2 feet; hence the distance *Parteemalli* from *Putchapolliam* = 120553.6 feet, and the observed angle at the S. E. end of the base = 112° 5′ 9″.87.

With the internal angle at *Perrioormalli,* equal 143° 37′ 32″.7 corrected for the chords, and the including sides, *Perrioormalli* from *Suddragherry,* equal 204679.3 feet, and *Perrioormalli* from *Vullunkota,* equal 152154.4 feet; by which the distance from *Suddragherry* to *Vullunkota* is found 339403.5 feet. The observed angle at *Perrioormalli* = 143° 37′ 44″.17.

The internal angle of *Munpotha,* corrected for the chords, equal 144° 29′ 34″.42 with the including sides, *Kunnimapotha* from *Munpotha,* equal 88877 feet, and *Munpotha* from *Punnae* station, equal 42737.2 feet; the direct distance from *Kunnimapotha* to *Punnae* station is found 126133.4 feet. Again, with the internal angle at *Koodunkolum,* corrected for the chords, equal 97° 44′ 36″, and the included sides, *Koodunkolum,* from *Kunnimapotha,* equal 121934.1 feet, and *Koodunkolum* from *Punnae* station, equal 19779.5 feet, the same direct distance from *Kunnimapotha* to *Punnae* station is found 126131.4 feet; the mean of which is 126132.4 feet. The angle at *Kunnimapotha* between *Koodunkolum* and *Punnae* station, corrected for an observed one, is 8° 56′ 21″.39, which is used in reducing the Arc.

5. *Reduction of the Distances to the Meridian of Dodagoontah Station.*

The Length of the Arc comprehended by the Parallels of *Putchapolliam* and *Punnae* Station.

STATIONS AT	NAMES OF PLACES.	Bearings referred to the Meridian of Dodagoontah.	Distances.	Distances on the		Distance from Putchapolliam on the	
				Perpendicular.	Meridian.	Perpendicular.	Meridian.
		° ′ ″	Feet.	Feet.	Feet.	Feet.	Feet.
Putchapolliam Station..	Parteemalli	7 56 29.74 S.W.	120553.6	16656.1 W.	119397.4 S.	166561. W.	119397.4 S.
Parteemalli	Permaul Hill	1 54 37.23 S.W.	133318.9	4444.2 W.	133244.8 S.	21100.3 W.	252642.2 S.
Permaul Hill..........	Suddragherry ..	11 14 52.96 S.E.	207080.1	40392.4 E.	203102.5 S.	19292.1 E.	455744.7 S.
Suddragherry..........	Vullunkota	3 13 50.25 S.W.	339403.5	19127.1 W.	338864.1 S.	165. E.	794608.8 S.
Vullunkota............	Kunnimapotha ..	0 10 35.28 S.W.	108363.9	333.8 W.	08363.3 S.	168.8 W.	902972.1 S.
Kunnimapotha	Punnae Station.	0 27 21.16 S.E.	126132.4	1003.6 E.	126128.4 S.	834.8 E.	1029100.5 S.

6. Zenith Distances of Stars, observed at *Putchapolliam* and *Punnae Station*, with their corrections for precession, nutation, aberration, and the semi-annual solar equation, back to the beginning of the year 1805.

Observations at Putchapolliam.

δ HYDRÆ.

Nearest Point on the Limb, 4° 40′. South.

1806. Month.	Face.	Observed Zenith Distance.	Correction.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	″	° ′ ″	°	°
April 13	E.	4 37 37.	24.52	4 37 13.22	93	93
14	W.	4 37 26.4	24.5	4 37 1.99	90	91
16	E.	4 37 36.24	24.45	4 37 11.79	93	92
17	W.	4 37 28.11	24.42	4 37 3.69	93	92
18	E.	4 37 35.24	24.40	4 37 10.84	93	93
19	W.	4 37 30.99	24.37	4 37 6.62	95	94
20	E.	4 37 36.49	24.34	4 37 12.15	93	93
21	W.	4 37 27.49	24.31	4 37 3.18	93	93
22	E.	4 37 35.24	24.29	4 37 10.95	85	85
23	W.	4 37 28.44	24.26	4 37 4.18	96	96
				Mean	92.4	92.2

ε HYDRÆ.

Nearest Point on the Limb, 3° 55′ South.

April 13	E.	3 52 33.74	25.31	3 52 8.43	93	93
14	W.	3 52 24.49	25.29	3 51 59.20	90	91
17	E.	3 52 36.74	25.21	3 52 11.53	93	92
18	W.	3 52 25.99	25.88	3 52 0.11	93	93
19	E.	3 52 32.69	25.16	3 52 7.53	95	94
21	W.	3 52 26.74	25.10	3 52 1.64	93	93
22	E.	3 52 35.49	25.08	3 52 10.41	85	85
23	W.	3 52 25.54	25.04	3 52 0. 5	96	96
				Mean	92.25	92.13

α CANCRI.

Nearest Point on the Limb, 1° 35′ North.

1806. Month.	Face.	Observed Zenith Distance.	Corrections.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	″ +	° ′ ″	°	°
April 14	W.	1 36 10.13	24.51	1 36 34.64	89	91
17	E.	1 36 4.25	24.42	1 36 28.67	93	92
18	W.	1 36 8.26	24.38	1 36 32.64	93	93
19	E.	1 36 3.03	24.34	1 36 27.37	95	94
20	W.	1 36 12.13	24.31	1 36 36.44	93	93
21	E.	1 36 3.13	24.27	1 36 27.4	93	92
22	W.	1 36 10.	24.23	1 36 34.23	95	94
23	E.	1 36 3.53	24.19	1 36 27.72	96	96
				Mean	93.37	93.13

ο LEONIS.

Nearest Point on the Limb, 0° 15′ South.

April 9	E.	0 13 52.87	29.96	0 13 22.91	89	88
10	W.	0 13 43.24	29.93	0 13 13.31	90	89
11	E.	0 13 51.87	29.89	0 13 21.98	90	89
14	E.	0 13 51.09	29.78	0 13 21.31	86	87
17	E.	0 13 52.67	29.65	0 13 23.02	91	92
18	W.	0 13 42.62	29.61	0 13 13.01	93	91
19	W.	0 13 41.99	29.57	0 13 12.42	92	93
20	W.	0 13 42.62	29.53	0 13 13.09	91	92
21	E.	0 13 53.25	29.49	0 13 23.76	93	91
22	W.	0 13 41.62	29.45	0 13 12.17	93	92
23	E.	0 13 53.75	29.41	0 13 24.34	94	94
24	W.	0 13 42.37	29.36	0 13 13.01	93	92
25	E.	0 13 52.25	29.32	0 13 22.93	92	92
26	W.	0 13 41.5	29.27	0 13 12.23	95	94
				Mean	91.43	91.14

REGULUS.

Nearest Point on the Limb, 1° 55′ North.

1806. Month.	Face.	Observed Zenith Distance.	Corrections.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	″ +	° ′ ″	°	°
April 11	E.	1 54 36.25	31.58	1 55 7.83	90	89
12	W.	1 54 43.	31.53	1 55 14.53	87	87
13	E.	1 54 32.8	31.48	1 55 4.28	88	89
14	W.	1 54 42.45	31.43	1 55 13.88	86	87
17	E.	1 54 36.75	31.28	1 55 8.03	91	91
18	W.	1 54 45.5	31.23	1 55 16.73	91	90
19	E.	1 54 34.8	31.18	1 55 5.98	92	92
20	W.	1 54 45.25	31.12	1 55 16.37	91	92
21	E.	1 54 36.62	31.07	1 55 7.69	91	91
22	W.	1 54 46.25	31.02	1 55 17.27	92	92
23	E.	1 54 34.87	30.97	1 55 5.84	93	93
24	W.	1 54 43.87	30.92	1 55 14.79	91	91
				Mean	90.25	90.33

ϑ LEONIS.

Nearest Point on the Limb, 5° 30′ North.

April 10	W.	5 29 16.5	35.35	5 29 51.85	87	87
11	E.	5 29 11.	35.27	5 29 46.27	86	85
12	W.	5 29 17.87	35.19	5 29 53.06	84	84
13	E.	5 29 8.62	35.10	5 29 43.72	83	85
14	W.	5 29 17.2	35.02	5 29 52.22	84	85
17	E.	5 29 9.87	34.77	5 29 44.64	90	91
18	W.	5 29 18.87	34.69	5 29 53.56	89	89
19	E.	5 29 12.5	34.60	5 29 47.10	91	91
20	W.	5 29 18.87	34.52	5 29 53.39	89	89
21	E.	5 29 11.	34.44	5 29 45.44	90	90
22	W.	5 29 18.75	34.35	5 29 53.10	88	88
23	E.	5 29 7.25	34.26	5 29 41.51	91	91
24	W.	5 29 18.	34.17	5 29 52.17	89	89
				Mean	87.77	88.

β LEONIS.

Nearest Point on the Limb, 4° 40′ North.

1806. Month.	Face.	Observed Zenith Distance.	Correc-tions.	Correct Zenith Distance.	Thermometers Upper.	Lower.
		° ′ ″	″ +	° ′ ″	°	°
April 10	W.	4 39 19.4	37.17	4 39 56.57	85	84
11	E.	4 39 13.67	37.09	4 39 50.76	85	84
12	W.	4 39 23.87	37.0	4 40 0.87	83	84
13	E.	4 39 12.87	36.91	4 39 49.78	83	84
14	W.	4 39 24.5	36.82	4 40 1.32	83	84
17	E.	4 39 15.	36.56	4 39 51.56	90	91
18	W.	4 39 21.9	36.47	4 39 58.37	88	88
19	E.	4 39 12.8	36.38	4 39 49.18	79	79
20	W.	4 39 24.5	36.28	4 40 0.78	88	88
21	E.	4 39 15.	36.19	4 39 51.19	89	89
23	W.	4 39 22.37	36.01	4 39 58.38	88	89
24	E.	4 39 13.25	35.91	4 39 49.16	89	89
26	W.	4 39 22.5	35.72	4 39 58.22	86	86
				Mean	85.85	86.08

ε VIRGINIS.

Nearest Point on the Limb, 1° 0′ North.

April 24	E.	1 0 12.	37.01	1 0 49.01	86	86
26	W.	1 0 21.95	36.81	1 0 58.76	85	85
27	E.	1 0 13.75	36.71	1 0 50.46	83	82
28	W.	1 0 22.63	36.61	1 0 59.24	85	86
30	E.	1 0 12.38	36.41	1 0 48.79	83	82
May 1	W.	1 0 23.	36.32	1 0 59.32	83	83
				Mean	84.17	84.

δ SERPENTIS.

Nearest Point on the Limb, 0° 10′ North.

1806. Month.		Face.	Observed Zenith Distance.	Corrections.	Correct Zenith Distance.	Thermometers. Upper.	Lower.
			° ′ ″	″ +	° ′ ″	°	°
April	19	E.	0 11 40.13	28.58	0 12 8.71	84	84
	20	W.	0 11 51.63	28.47	0 12 20.1	82	82
	21	E.	0 11 42.13	28.36	0 12 10.49	83	83
	22	W.	0 11 51.23	28.24	0 12 19.47	83	83
	23	E.	0 11 40.49	28.13	0 12 8.62	83	83
	27	W.	0 11 50.36	27.63	0 12 17.99	81	81
	30	E.	0 11 41.38	27.24	0 12 8.62	81	81
May	1	W.	0 11 51.58	27.11	0 12 18.69	82	82
					Mean	82.38	82.37

α SERPENTIS.

Nearest Point on the Limb, 3° 55′ South.

				—			
April	21	E.	3 57 15.76	26.76	3 56 49.	83	83
	22	W.	3 57 8.33	26.66	3 56 41.67	83	83
	23	E.	3 57 15.51	26.56	3 56 48.95	83	83
	27	W.	3 57 7.26	26.15	3 56 41.11	81	81
	30	E.	3 57 12.18	25.81	3 56 46.37	81	81
May	1	W.	3 57 6.51	25.70	3 56 40.81	82	82
					Mean	82.17	82.17

γ SERPENTIS.

Nearest Point on the Limb, 5° 20′ North.

				+			
April	19	E.	5 18 3.37	26.93	5 18 30.3	84	84
	20	W.	5 18 14.74	26.79	5 18 41.53	82	82
	21	E.	5 18 4.97	26.65	5 18 31.62	83	83
	22	W.	5 18 14.67	26.50	5 18 41.17	82	83
	23	E.	5 18 5.12	26.36	5 18 31.48	83	83
	27	W.	5 18 14.62	25.75	5 18 40.37	81	81
	30	E.	5 18 5.39	25.28	5 18 30.67	81	81
May	1	W.	5 18 15.92	25.11	5 18 41.03	81	81
					Mean	82.13	82.25

α HERCULIS.

Nearest Point on the Limb, 3° 35′ North.

1806. Month.		Face.	Observed Zenith Distance.	Corrections.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
			° ′ ″+	″+	° ′ ″	°	°
April	27	E.	3 37 14.98	16.37	3 37 31.35	80	80
	28	W.	3 37 21.93	16.22	3 37 38.15	83	83
	30	E.	3 37 16.26	15.89	3 37 32.5	80	80
May	1	W.	3 37 23.76	15.73	3 37 39.49	81	80
	2	E.	3 37 15.51	15.58	3 37 31.09	81	81
					Mean	81.2	80.8

α OPHIUCHI.

Nearest Point on the Limb, 1° 40′ North.

				+			
April	24	E.	1 42 41.51	14.26	1 42 55.77	82	82
	25	W.	1 42 50.76	14.13	1 43 4.89	83	82
	27	E.	1 42 40.26	13.84	1 42 54.1	80	80
	28	W.	1 42 48.26	13.69	1 43 1.95	83	83
	30	E.	1 42 40.76	13.40	1 42 54.16	80	80
May	1	W.	1 42 50.51	13.24	1 43 3.75	81	80
	2	E.	1 42 42.26	13.09	1 42 55.35	81	81
					Mean	81.43	81.14

ε AQUILÆ.

Nearest Point on the Limb, 2° 35′ North.

				+			
April	12	W	2 35 11.75	3.81	2 35 15.56	76	75
	13	E.	2 35 7.	3.72	2 35 10.72	78	79
	14	W.	2 35 15.25	3.62	2 35 18.87	79	80
	15	E.	2 35 6.5	3.54	2 35 10.04	76	75
	16	W.	2 35 12.6	3.44	2 35 16.04	78	78
	17	E.	2 35 8.5	3.33	2 35 11.83	77	77
	18	W.	2 35 15.	3.23	2 35 18.23	80	79
	20	E.	2 35 7.5	2.99	2 35 10.49	79	79
	21	W.	2 35 17.5	2.87	2 35 20.37	80	80
	24	E.	2 35 7.	2.50	2 35 9.5	80	80
	25	W.	2 35 15.75	2.37	2 35 18.12	81	81
	26	E.	2 35 6.88	2.23	2 35 9.11	82	82
	28	W.	2 35 15.	1.85	2 35 16.85	81	82
	30	E.	2 35 7.25	1.65	2 35 8.9	80	80
May	1	W.	2 35 17.38	1.49	2 35 18.87	80	80
	2	E.	2 35 7.	1.34	2 35 8.34	80	80
					Mean	79.2	79.2

γ AQUILÆ.

Nearest Point on the Limb, 0° 50′ South.

1806. Month.	Face.	Observed Zenith Distance.	Correction.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	+ ″	° ′ ″	°	°
April 20	W.	0 50 42.37	3.58	0 50 45.95	80	80
21	W.	0 50 43.5	3.69	0 50 47.19	80	80
22	E.	0 50 48.5	3.79	0 50 52.29	81	80
23	E.	0 50 50.13	3.91	0 50 54.04	81	81
24	E.	0 50 50.	4.04	0 50 54.04	80	80
26	W.	0 50 42.5	4.30	0 50 46.80	82	81
27	E.	0 50 50.25	4.43	0 50 54.68	80	80
28	W.	0 50 42.38	4.56	0 50 46.94	81	81
29	E.	0 50 47.25	4.69	0 50 51.94	80	80
30	W.	0 50 41.	4.84	0 50 45.84	80	80
May 1	W.	0 50 41.13	4.98	0 50 46.11	81	81
2	E.	0 50 48.63	5.12	0 50 53.75	80	79
				Mean	80.5	80.25

ATAIR.

Nearest Point on the Limb, 2° 40′ South.

			+			
April 18	W.	2 37 44.24	4.95	2 37 49.19	80	79
19	E.	2 37 48.44	5.05	2 37 53.49	80	79
21	W.	2 37 44.24	5.26	2 37 49.5	80	80
22	E.	2 37 46.99	5.38	2 37 52.37	81	80
23	W.	2 37 43.74	5.50	2 37 49.24	81	81
24	E.	2 37 48.74	5.62	2 37 54.36	80	80
25	W.	2 37 42.37	5.75	2 37 48.12	82	82
26	E.	2 37 48.37	5.88	2 37 54.25	82	81
27	W.	2 37 40.62	6.01	2 37 46.63	80	80
28	E.	2 37 50.87	6.14	2 37 57.01	81	81
29	W.	2 37 41.24	6.28	2 37 47.52	80	80
30	E.	2 37 46.87	6.41	2 37 53.28	80	80
May 1	W.	2 37 42.74	6.56	2 37 49.30	81	81
2	E.	2 37 48.49	6.71	2 37 55.20	80	79
				Mean	80.57	80.21

β AQUILÆ.

Nearest Point on the Limb, 5° 5′ South.

1806. Month.		Face.	Observed Zenith Distance.			Corrections.	Correct Zenith Distance.			Thermometers. Upper.	Lower.
			°	′	″	+	°	′	″	°	°
April	22	E.	5	3	49.24	5.55	5	3	54.79	81	80
	23	W.	5	3	37.62	5.66	5	3	43.28	81	81
	24	E.	5	3	49.5	5.79	5	3	55.29	80	80
	25	W.	5	3	40.5	5.90	5	3	46.4	82	82
	26	E.	5	3	47.75	6.02	5	3	53.77	82	81
	27	W.	5	3	40.75	6.15	5	3	46.9	80	81
	28	E.	5	3	49.37	6.28	5	3	55.65	81	80
	29	W.	5	3	40.	6.42	5	3	46.42	80	80
	30	E.	5	3	49.12	6.55	5	3	55.67	80	80
May	1	W.	5	3	41.37	6.69	5	3	48.06	81	81
	2	E.	5	3	47.37	6.83	5	3	54.2	80	79
									Mean	80.73	80.5

β DELPHINI.

Nearest Point on the Limb, 2° 55′ North.

						−					
May	2	E.	2	55	47.5	9.93	2	55	37.57	79	79
		W.	2	55	58.25	10.23	2	55	48.02	74	74
									Mean	76.5	76.5

Observations at Punnae Station.

δ HYDRÆ.

Nearest Point on the Limb, 1° 45′ South.

						− ′ ″					
1809.											
April	12	E.	1	48	11.01	1 5.14	1	47	5.87	84	84
	14	E.	1	48	8.51	1 5.08	1	47	3.43	86	85
	16	W.	1	48	1.26	1 5.02	1	46	56.24	85	84
	17	E.	1	48	9.51	1 4.99	1	47	4.52	84	83
	18	W.	1	47	58.76	1 4.96	1	46	53.8	85	84
	19	W.	1	47	58.89	1 4.92	1	46	53.97	84	84
	20	W.	1	47	57.01	1 4.89	1	46	52.12	84	84
	23	E.	1	48	10.26	1 4.78	1	47	5.48	83	83
	24	W.	1	47	59.26	1 4.74	1	46	54.52	84	84
	25	E.	1	48	10.76	1 4.72	1	47	6.04	85	85
	26	W.	1	48	1.26	1 4.68	1	46	56.58	87	87
									Mean	84.64	84.28

ε HYDRÆ.

Nearest Point on the Limb, 1° 5′ South

1809. Month.	Face.	Observed Zenith Distance	Correc-tions.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	′ ″	° ′ ″	°	°
April 12	E.	1 3 10.87	1 7.53	1 2 3.34	84	84
13	W.	1 2 57.74	1 7.5	1 1 50.24	84	83
14	E.	1 3 9.24	1 7.47	1 2 1.77	86	85
16	W.	1 3 1.74	1 7.4	1 1 54.34	85	84
17	E.	1 3 10.37	1 7.36	1 2 3.01	84	83
18	W.	1 3 0.24	1 7.33	1 1 52.91	85	84
19	E.	1 3 10.87	1 7.30	1 2 3.57	84	84
20	W.	1 2 59.87	1 7.26	1 1 52.61	84	84
21	E.	1 3 10.39	1 7.23	1 2 3.16	81	81
23	W.	1 3 1.87	1 7.15	1 1 54.72	83	83
24	E.	1 3 10.24	1 7.12	1 2 3.12	84	84
25	W.	1 2 59.37	1 7.09	1 1 52.28	85	85
26	E.	1 3 13.24	1 7.05	1 2 6.19	87	87
				Mean	84.23	83.92

α CANCRI.

Nearest Point on the Limb, 4° 25′ North.

			+			
April 12	E.	4 25 25.	1 8.12	4 26 33.12	84	84
13	W.	4 25 38.13	1 8.08	4 26 46.21	84	83
14	E.	4 25 27.63	1 8.04	4 26 35.67	86	85
16	W.	4 25 36.13	1 7.97	4 26 44.1	85	84
17	E.	4 25 25.	1 7.92	4 26 32.92	84	83
18	W.	4 25 34.13	1 7.87	4 26 42.0	85	84
19	E.	4 25 25.5	1 7.83	4 26 33.33	84	84
20	W.	4 25 35.63	1 7.79	4 26 43.42	84	84
21	E.	4 25 27.	1 7.75	4 26 34.75	81	81
23	W.	4 25 32.25	1 7.65	4 26 39.9	83	83
24	E.	4 25 26.75	1 7.61	4 26 34.36	84	84
25	W.	4 25 35.5	1 7.57	4 26 43.07	85	85
26	E.	4 25 25.88	1 7.52	4 26 33.4	87	87
				Mean	84.23	83.92

υ LEONIS.

Nearest Point on the Limb, 2° 35′ North.

1809. Month.		Face.	Observed Zenith Distance.			Corrections. +		Correct Zenith Distance			Thermometers Upper.	Thermometers Lower.
			°	′	″	′	″	°	′	″	°	°
April	12	E.	2	35	25.13	1	20.13	2	36	45.26	84	84
	13	W.	2	35	36.63	1	20.09	2	36	56.72	84	83
	14	E.	2	35	23.63	1	20 04	2	36	43.67	85	84
	16	W.	2	35	34.13	1	19.94	2	36	54.07	85	84
	17	E.	2	35	23.88	1	19.90	2	36	43.78	84	83
	18	W.	2	35	34.5	1	19.85	2	36	54.35	84	83
	19	E.	2	35	23.50	1	19.80	2	36	43.3	84	84
	20	W.	2	35	34.5	1	19.75	2	36	54.25	84	84
	23	E.	2	35	23.25	1	19.61	2	36	42.86	83	83
	24	W.	2	35	35.38	1	19.55	2	36	54.93	83	83
	25	E.	2	35	24.5	1	19.50	2	36	44.	84	84
	26	W.	2	35	35.75	1	19.45	2	36	55.2	85	85
	27	E.	2	35	24.25	1	19.40	2	36	43.65	85	86
	28	W.	2	35	36.88	1	19.35	2	36	56.23	86	87
	29	E.	2	35	23.63	1	19 30	2	36	42.93	84	85
	30	W.	2	35	36.63	1	16.25	2	36	55.88	87	87
May	2	E.	2	35	23.38	1	19.15	2	36	42.53	84	84
	3	W.	2	35	38.	1	19.09	2	36	57.09	82	82
	5	E.	2	35	25.5	1	18 97	2	36	44.47	84	84
	6	W.	2	35	34.75	1	18.93	2	36	53.68	84	84
	7	E.	2	35	25.88	1	18 87	2	36	44.75	84	84
										Mean	84.14	84.24

REGULUS.

Nearest Point on the Limb, 4° 45′ North.

April	12	E.	4	43	51.87	1	24.53	4	45	16.4	84	84
	13	W.	4	44	2.	1	24.48	4	45	26.48	84	83
	14	E.	4	43	49.87	1	24.42	4	45	14.29	83	82
	16	W.	4	43	59.37	1	24.31	4	45	23.68	85	84
	17	E.	4	43	49.87	1	24.25	4	45	14.12	84	83
	18	W.	4	44	2.	1	24.19	4	45	26.19	83	82
	20	E.	4	43	49.	1	24.07	4	45	13.07	83	83
	24	W.	4	43	59.5	1	23.82	4	45	23.32	82	83
	25	E.	4	43	51.12	1	23.77	4	45	14.89	82	83
	26	W.	4	44	0.5	1	23.70	4	45	24.2	82	83
	27	E.	4	43	48.87	1	23.63	4	45	12.5	84	84
	28	W.	4	44	0.37	1	23.57	4	45	23.94	84	85
	29	E.	4	43	48.57	1	23.52	4	45	11.89	83	84
	30	W.	4	44	1.62	1	23.45	4	45	25.07	85	85
May	2	E.	4	43	48.87	1	23.33	4	45	12.2	83	83
	3	W.	4	44	2.87	1	23.27	4	45	26.14	82	82
	5	E.	4	43	49.12	1	23.14	4	45	12.26	84	84
	6	W.	4	44	1.87	1	23.08	4	45	24.95	83	83
	7	E.	4	43	50.87	1	23.02	4	45	13.89	83	83
	8	W.	4	44	2.87	1	22.96	4	45	25.63	82	82
										Mean	83.25	83.25

θ LEONIS.

Nearest Point on the Limb, 8° 20′ North.

1809. Month.	Face.	Observed Zenith Distance.	Corrections.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	′ ″ +	° ′ ″	°	°
April 17	E.	8 18 17.37	1 31.94	8 19 49.31	83	82
18	W.	8 18 28.87	1 31.85	8 20 0.72	83	82
19	E.	8 18 20.74	1 31.76	8 19 52.5	83	83
20	W.	8 18 28.87	1 31.67	8 20 0.54	83	83
23	E.	8 18 15.87	1 31.40	8 19 47.27	82	82
24	W.	8 18 28.89	1 31.30	8 20 0.19	82	83
25	E.	8 18 15.37	1 31.22	8 19 46.59	82	83
26	W.	8 18 31.87	1 31.12	8 20 2.99	82	83
28	E.	8 18 17.37	1 30.94	8 19 48.31	84	85
29	W.	8 18 26.87	1 30.84	8 19 57.71	83	83
30	E.	8 18 17.39	1 30.75	8 19 48.14	85	85
May 3	W.	8 18 32.	1 30.48	8 20 2.48	82	82
4	E.	8 18 18.12	1 30 39	8 19 48.51	82	83
5	W.	8 18 33.24	1 30.30	8 20 3.54	82	83
6	E.	8 18 18.74	1 30.22	8 19 48.96	82	82
7	W.	8 18 31.62	1 30.13	8 20 1.75	82	83
				Mean	82.62	82.87

β LEONIS.

Nearest Point on the Limb, 7° 30′ North.

			+			
April 12	E.	7 28 22.87	1 34.7	7 29 57.57	84	84
13	W.	7 28 37.37	1 34.61	7 30 11.98	84	83
14	E.	7 28 25.87	1 34.51	7 30 0.38	83	82
16	W.	7 28 34.24	1 34.33	7 30 8.57	83	82
17	E.	7 28 21.37	1 34.24	7 29 55.61	83	82
18	W.	7 28 32.12	1 34.14	7 30 6.26	83	82
19	E.	7 28 25.24	1 34.04	7 29 59.28	82	82
20	W.	7 28 33.62	1 33.93	7 30 7.55	81	81
23	E.	7 28 25.87	1 33.64	7 29 59.51	82	82
24	W.	7 28 35.37	1 33.54	7 30 8.91	82	83
25	E.	7 28 26.87	1 33.44	7 30 0.31	81	82
26	W.	7 28 35.87	1 33.34	7 30 9.21	82	83
28	E.	7 28 25.87	1 33.14	7 29 59.01	84	85
29	W.	7 28 38.87	1 33.04	7 30 11.91	83	83
30	E.	7 28 22.87	1 32.93	7 29 55.8	82	82
May 2	W.	7 28 38.97	1 32.74	7 30 11.71	81	82
4	W.	7 28 37.87	1 32.54	7 30 10.41	82	83
5	E.	7 28 24.12	1 32.44	7 29 56.56	82	83
6	W.	7 28 38.87	1 32.34	7 30 11.21	82	82
7	E.	7 28 25.47	1 32.25	7 29 57.72	82	82
				Mean	82.38	82.48

ε VIRGINIS.

Nearest Point on the Limb, 3° 50′ North.

1809. Month.		Face.	Observed Zenith Distance.	Corrections.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
			° ′ ″	′ ″ +	° ′ ″	°	°
April	18	W.	3 49 36.62	1 31.18	3 51 7.8	82	81
	19	E.	3 49 26.	1 31.09	3 50 57.09	82	82
	20	W.	3 49 35.	1 30.99	3 51 5.99	80	81
	23	E.	3 49 26.	1 30.69	3 50 56.69	82	82
	25	W.	3 49 35.37	1 30.49	3 51 5.86	81	82
	26	E.	3 49 25.87	1 30.38	3 50 56.25	82	83
	28	W.	3 49 38.	1 30.17	3 51 8.17	83	84
	29	E.	3 49 26.	1 30.07	3 50 56.07	83	83
	30	W.	3 49 39.	1 29.97	3 51 8.97	82	82
May	3	E.	3 49 27.87	1 29.64	3 50 57.51	82	82
	4	W.	3 49 38.25	1 29.54	3 51 7.79	81	82
	5	E.	3 49 26.75	1 29.43	3 50 56.18	82	82
	6	W.	3 49 37.12	1 29.32	3 51 6.44	81	82
	7	E.	3 49 28.6	1 29.21	3 50 57.81	81	82
					Mean	81.71	82.14

δ SERPENTIS.

Nearest Point on the Limb, 3° North.

				″ +			
April	18	W.	3 1 30.76	57.96	3 2 28.72	80	79
	19	E.	3 1 20.13	57.85	3 2 17.98	80	80
	20	W.	3 1 29.26	57.75	3 2 27.01	80	80
	23	E.	3 1 20.63	57.39	3 2 18.02	81	81
	24	W.	3 1 29.63	57.27	3 2 26.9	81	81
	25	E.	3 1 20.13	57.14	3 2 17.27	80	80
	26	W.	3 1 29.13	57.01	3 2 26.14	82	82
	27	E.	3 1 20.13	56.89	3 2 17.02	83	83
	28	W.	3 1 32.26	56.76	3 2 29.02	84	84
	29	E.	3 1 20.13	56.63	3 2 16.76	83	83
	30	W.	3 1 32.51	56.5	3 2 29.01	83	83
May	3	E.	3 1 19.13	56.09	3 2 15.22	80	80
	5	W.	3 1 32.38	55.81	3 2 28.19	82	82
	6	E.	3 1 20.63	55.66	3 2 16.29	81	81
	7	W.	3 1 32.63	55.52	3 2 28.15	81	81
					Mean	81.33	81.33

α SERPENTIS.

Nearest Point on the Limb, 1° 5′ South.

1809. Month.		Face.	Observed Zenith Distance.	Correc-tions.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
			° ′ ″	− ″	° ′ ″	°	°
April	18	W.	1 7 26.26	53.59	1 6 32.67	80	79
	19	E.	1 7 36.39	53.51	1 6 42.88	80	80
	20	W.	1 7 25.26	53.41	1 6 31.85	80	80
	23	E.	1 7 33.64	53.11	1 6 40.53	81	81
	24	W.	1 7 25.76	53.02	1 6 32.74	81	81
	25	E.	1 7 36.01	52.92	1 6 43.09	80	80
	26	W.	1 7 24.51	52.81	1 6 31.7	82	82
	27	E.	1 7 35.89	52.70	1 6 43.19	83	83
	28	W.	1 7 24.26	52.59	1 6 31.67	84	84
	29	E.	1 7 36.14	52.48	1 6 43.66	83	83
	30	W.	1 7 22.89	52.36	1 6 30.53	83	83
May	3	E.	1 7 35.01	52.01	1 6 43.	80	80
	5	W.	1 7 23.26	51.78	1 6 31.48	81	82
	6	E.	1 7 34.01	51.66	1 6 42.35	81	81
	7	W.	1 7 22.01	51.53	1 6 30.48	81	81
					Mean	81.33	81.33

γ SERPENTIS.

Nearest Point on the Limb, 8° 5′ North.

				+			
April	18	W.	8 7 52.26	51.43	8 8 43.69	80	79
	19	E.	8 7 42.39	51.3	8 8 33.69	80	80
	20	W.	8 7 52.14	51.16	8 8 43.3	80	80
	23	E.	8 7 40.51	50.72	8 8 31.23	81	81
	24	W.	8 7 52.89	50.57	8 8 43.46	81	81
	25	E.	8 7 42.26	50.43	8 8 32.69	80	80
	26	W.	8 7 56.39	50.27	8 8 46.66	82	82
	27	E.	8 7 43.64	50.11	8 8 33.75	83	83
	28	W.	8 7 55.89	49.96	8 8 45.85	84	84
	29	E.	8 7 42.39	49.80	8 8 32.19	83	83
	30	W.	8 7 56.64	49.64	8 8 46.28	83	83
May	3	E.	8 7 44.14	49.14	8 8 33.28	80	80
	6	W.	8 7 56.89	48.64	8 8 45.53	81	81
	7	E.	8 7 46.26	48.47	8 8 34.73	80	81
					Mean	81.36	81.29

α HERCULIS.

Nearest Point on the Limb, 6° 30′ North.

1809. Month.		Face.	Observed Zenith Distance.			Correc-tions.	Correct Zenith Distance.			Thermometers Upper.	Thermometers Lower.
			°	′	″	″ +	°	′	″	°	°
April	15	W.	6	27	26.74	22.65	6	27	49.39	81	81
	16	E.	6	27	13.74	22.54	6	27	36.28	81	80
	17	W.	6	27	26.61	22.43	6	27	49.04	79	78
	18	E.	6	27	14.74	22.31	6	27	37.05	80	79
	19	W.	6	27	25.11	22.17	6	27	47.28	79	79
	21	E.	6	27	12.74	21.91	6	27	34.65	77	77
	23	W.	6	27	25.61	21.64	6	27	47.25	80	80
	24	E.	6	27	13.37	21.5	6	27	34.87	80	80
	25	W.	6	27	25.61	21.35	6	27	46.96	79	79
	26	E.	6	27	14.74	21.21	6	27	35.95	82	82
	27	W.	6	27	27.24	21.07	6	27	48.31	83	83
	28	E.	6	27	13.74	20.91	6	27	34.65	83	83
	29	W.	6	27	27.74	20.75	6	27	48.49	83	83
	30	E.	6	27	13.61	20.59	6	27	34.2	83	83
									Mean	80.5	80.29

α OPHIUCHI.

Nearest Point on the Limb, 4° 35′ North.

						+					
April	12	E.	4	32	45.74	16.12	4	33	1.86	80	79
	13	W.	4	32	58.37	16.03	4	33	14.40	82	81
	14	E.	4	32	46.87	15.93	4	33	2.8	82	81
	15	W.	4	32	57.74	15.83	4	33	13.57	81	80
	16	E.	4	32	45.24	15.72	4	33	0.96	81	80
	17	W.	4	32	57.24	15.61	4	33	12.85	79	78
	18	E.	4	32	47.24	15.49	4	33	2.73	80	79
	19	W.	4	32	57.87	15.38	4	33	13.25	79	79
	20	E.	4	32	44.24	15.26	4	33	59.5	79	79
	21	W.	4	32	56.87	15.13	4	33	12.	77	77
	23	E.	4	32	44.74	14.87	4	33	59.61	80	80
	24	W.	4	32	55.29	14.74	4	33	10.03	80	80
	25	E.	4	32	46.74	14.61	4	33	1 35	79	79
	26	E.	4	32	47.24	14.47	4	33	1.71	82	82
	27	W.	4	32	58.24	14.33	4	33	12.57	83	83
	28	W.	4	32	59.74	14.19	4	33	13.93	83	83
	29	E.	4	32	47.74	14.04	4	33	1.78	83	83
	30	W.	4	32	59.74	13.89	4	33	13.63	83	83
									Mean	80.72	80.33

ε AQUILÆ.

Nearest Point on the Limb, 5° 25′ North.

1809. Month.	Face.	Observed Zenith Distance.	Corrections.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	″ —	° ′ ″	°	°
April 13	W.	5 25 50.5	18.	5 25 32.5	82	81
28	E.	5 25 36.13	19.71	5 25 16.42	82	83
29	W.	5 25 51.13	19.85	5 25 31.28	82	82
30	E.	5 25 36.88	20.01	5 25 16.87	82	82
May 1	W.	5 25 52.5	20.15	5 25 32.35	79	79
3	E.	5 25 35.	20.45	5 25 14.55	78	78
6	W.	5 25 51.63	20.92	5 25 30.71	81	81
8	E.	5 25 37.63	21.26	5 25 16.37	80	80
				Mean	80.75	80.75

γ AQUILÆ.

Nearest Point on the Limb, 2° North.

			—			
April 28	W.	1 59 59.5	35.85	1 59 23.65	82	83
29	E.	1 59 51.87	35.98	1 59 15.89	82	82
May 3	E.	1 59 48.37	36.54	1 59 11.83	78	78
4	W.	1 59 58.75	36.69	1 59 22.06	79	80
6	E.	1 59 51.5	36.99	1 59 14.51	80	81
7	W.	1 59 57.5	37.15	1 59 20.35	80	81
9	E.	1 59 49.25	37.46	1 59 11.79	81	80
				Mean	80.2	80.71

ATAIR.

Nearest Point on the Limb, 0° 10′ North.

1809. Month.	Face.	Observed Zenith Distance.	Correc- tions.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
			−			
April 28	W.	0° 13′ 1″.39	39″.5	0° 12′ 21″.89	82°	83°
29	E.	0 12 50.46	39.63	0 12 10.83	82	82
30	W.	0 13 0.89	39.76	0 12 21.13	82	82
May 3	E.	0 12 49.01	40.19	0 12 8.82	78	78
4	W.	0 13 0.01	40.33	0 12 19.68	79	80
6	E.	0 12 48.79	40.63	0 12 8.16	80	81
7	W.	0 12 59.26	40.78	0 12 18.48	80	81
9	E.	0 12 49.51	41.10	0 12 8.41	81	80
				Mean	80.4	80.88

β AQUILÆ.

Nearest Point on the Limb, 2° 15′ South.

			+			
April 28	W.	2 13 4.61	37.89	2 13 42.5	82	83
May 3	E.	2 13 11.87	38.55	2 13 50.42	78	78
4	W.	2 13 1.87	38.70	2 13 40.57	79	80
6	E.	2 13 12.62	38.97	2 13 51.59	80	81
9	E.	2 13 10.12	39.43	2 13 49.55	81	80
				Mean	80	80.4

β DELPHINI.

Nearest Point on the Limb, 5° 45′ North.

			−			
May 6	W.	5 46 51.13	51.21	5 45 59.92	80	81
7	E.	5 46 37.5	51.37	5 45 46.13	78	80
9	W.	5 46 49.63	51.68	5 45 57.95	80	80
				Mean	79.34	80.34

7. MEANS of the Zenith Distances, taken on the right and left arcs corrected for refraction, equation of the sectorial tube, and the mean runs of the micrometer.

Zenith Distances at Putchapolliam.

δ HYDRÆ.

1806.	Left Arc.	1806.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	
April 13	4 37 13.22	April 14	4 37 1.99	Mean ....4° 37′ 7″.86
16	11.79	17	3.69	Refraction, &c. &c. + 4.79
18	10.84	19	6.62	
20	12.15	21	3.18	Zenith Distance ..4 37 12.65
22	10.95	23	4.18	
Mean	4 37 11.79	Mean	4 37 3.93	

ε HYDRÆ.

April 13	3 52 8.43	April 14	3 51 59.2	Mean 3 52 4.92
17	11.53	18	52 0.11	Refraction, &c. &c. + 4.05
19	7.53	21	1.64	
22	10.41	23	0.5	Zenith Distance ..3 52 8.97
Mean	3 52 9.48	Mean	3 52 0.36	

α CANCRI.

April 14	1 36 34.64	April 17	1 36 28.67	Mean 1 36 31.14
18	32.64	19	27.37	Refraction, &c. &c. + 1.5
20	36.44	21	27.4	
22	34.23	23	27.72	Zenith Distance ..1 36 32.64
Mean	1 36 34.49	Mean	1 36 27.79	

ο LEONIS.

1806.	Left Arc.	1806.	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
April 9	0 13 22.91	April 10	0 13 13.31		0 13 17.82
11	21.98	18	13.01	Refraction, &c. &c.	+ 0.34
14	21.31	19	12.42		
17	23.02	20	13.09	Zenith Distance ..	0 13 18.16
21	23.76	22	12.17		
23	24.34	24	13.01		
25	22.93	26	12.23		
Mean	0 13 22.89	Mean	0 13 12.75		

REGULUS.

April 12	1 55 14.53	April 11	1 55 7.83		1 55 11.1
14	13.88	13	4.28	Refraction, &c. &c.	+ 1.89
18	16.73	17	8.03		
20	16.37	19	5.98	Zenith Distance ..	1 55 12.99
22	17.27	21	7.69		
24	14.79	23	5.84		
Mean	1 55 15.59	Mean	1 55 6.61		

ϑ LEONIS.

April 10	5 29 51.85	April 11	5 29 46.27		5 29 48.77
12	53.06	13	43.72	Refraction, &c. &c.	+ 5.49
14	52.22	17	44.64		
18	53.56	19	47.10	Zenith Distance ..	5 29 54.26
20	53.39	21	45.44		
22	53.1	23	41 51		
24	52.17				
Mean	5 29 52.76	Mean	5 29 44.78		

β LEONIS.

1806.	Left Arc.	1806.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 10	4 39 56.57	April 11	4 39 50.76	4 39 54.74
12	60.87	13	49.78	Refraction, &c. &c. + 4.66
14	61.32	17	51.56	
18	58.37	19	49.18	Zenith Distance . . 4 39 59.4
20	60.78	21	51.19	
23	58.38	24	49.16	
26	58.22			
Mean	4 39 59.22	Mean	4 39 50.27	

ε VIRGINIS.

April 26	1 0 58.76	April 24	1 0 49.01	1 0 54.26
28	59.24	27	50.46	Refraction, &c. &c. + 0.94
May 1	59.32	30	48.79	
				Zenith Distance . . 1 0 55.20
Mean	1 0 59.10	Mean	1 0 49.42	

δ SERPENTIS.

April 20	0 12 20.1	April 19	0 12 8.71	0 12 14.09
22	19.47	21	10.49	Refraction, &c. &c. + 0.06
27	17.99	23	8.62	
May 1	18.69	30	8.62	Zenith Distance . . 0 12 14.15
Mean	0 12 19.06	Mean	0 12 9.11	

α SERPENTIS.

April 21	3 56 49.	April 22	3 56 41.67	3 56 44.65
23	48.95	27	41.11	Refraction, &c. &c. + 3.81
30	46.37	May 1	40.81	
				Zenith Distance . . 3 56 48.46
Mean	3 56 48.11	Mean	3 56 41.20	

γ SERPENTIS.

1806.	Left Arc.	1806.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 20	5 18 41.53	April 19	5 18 30.3	5 18 36.02
22	41.17	21	31.62	Refraction, &c. &c. + 5.39
27	40.37	23	31.48	
May 1	41.03	30	30.67	Zenith Distance ..5 18 41.41
Mean	5 18 41.03	Mean	5 18 31.02	

α HERCULIS.

April 28	3 37 38.15	April 27	3 37 31.35	3 37 35.17
May 1	39.49	30	32.15	Refraction, &c. &c. + 3.41
		May 2	31.09	
				Zenith Distance ..3 37 38.58
Mean	3 37 38.82	Mean	3 37 31.53	

α OPHIUCHI.

April 25	1 43 4.89	April 24	1 42 55.77	1 42 59.19
28	1.95	27	54.1	Refraction, &c. &c. + 1.5
May 1	3.75	30	54.16	
		May 2	55.35	Zenith Distance ..1 43 0.69
Mean	1 43 3.53	Mean	1 42 54.85	

ε AQUILÆ.

April 12	2 35 15.56	April 13	2 35 10.72	2 35 13.87
14	18.87	15	10.04	Refraction, &c. &c. + 2.57
16	16.04	17	11.83	
18	18.23	20	10.49	Zenith Distance ..2 35 16.44
21	20.37	24	9.50	
25	18.12	26	9.11	
28	16.85	30	8.9	
May 1	18.87	May 2	8.34	
Mean	2 35 17.86	Mean	2 35 9.87	

γ AQUILÆ.

1806.	Left Arc.	1806.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 22	0 50 52.29	April 20	0 50 45.95	0 50 49.96
23	54.04	21	47.19	Refraction, &c. &c. + 0.78
24	54.04	26	46.8	
27	54.68	28	46.94	Zenith Distance ..0 50 50.74
29	51.94	30	45.84	
May 2	53.75	May 1	46.11	
Mean	0 50 53.46	Mean	0 50 46.47	

ATAIR.

April 19	2 37 53.49	April 18	2 37 49.19	2 37 51.38
22	52.37	21	49.5	Refraction, &c. &c. + 2.75
24	54.36	23	49.24	
26	54.25	25	48.12	Zenith Distance ..2 37 54.13
28	57.01	27	46.63	
30	53.28	29	47.52	
May 2	55.2	May 1	49.3	
Mean	2 37 54.28	Mean	2 37 48.48	

β AQUILÆ.

April 22	5 3 54.79	April 23	5 3 43.28	5 3 50.55
24	55.29	25	46.4	Refraction, &c. &c. + 5.13
26	53.77	27	46.9	
28	55.65	29	46.42	Zenith Distance ..5 3 55.68
30	55.67	May 1	48.06	
May 2	54.2			
Mean	5 3 54.9	Mean	5 3 46.21	

β DELPHINI.

May 4	2 55 48.02	May 2	2 55 37.57	2 55 42.80
				Refraction, &c. &c. + 2.88
Mean	2 55 48.02	Mean	2 55 37.57	Zenith Distance ..5 55 45.68

Observations at Punnae Station.

δ HYDRÆ.

1809.	Left Arc.	1809.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 12	1 47 5.87	April 16	1 46 56.24	1 46 59.8
14	3.43	18	53.8	Refraction, &c. &c. + 1.57
17	4.52	19	53.97	
23	5.48	20	52.12	Zenith Distance ..1 47 1.37
25	6.04	24	54.52	
		26	56.58	
Mean	1 47 5.07	Mean	1 46 54.54	

ε HYDRÆ.

April 12	1 2 3.34	April 13	1 1 50.24	1 1 58.15
14	1.77	16	54.34	Refraction, &c. &c. + 1.16
17	3.01	18	52.91	
19	3.57	20	52.61	Zenith Distance ..1 1 59.31
21	3.16	23	54.72	
24	3.12	25	52.28	
26	6.19			
Mean	1 2 3.45	Mean	1 1 52.85	

α CANCRI.

April 13	4 26 46.21	April 12	4 26 33.12	4 26 38.53
16	44.10	14	35.67	Refraction, &c. &c. + 4.38
18	42.0	17	32.92	
20	43.42	19	33.33	Zenith Distance ..4 26 42.91
23	39.90	21	34.75	
25	43.07	24	34.36	
		26	33.4	
Mean	4 26 43.12	Mean	4 26 33.94	

ο LEONIS.

1809.	Left Arc.	1809.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	
April 13	2 36 56.72	April 12	2 36 45.26	° ′ ″ 2 36 49.49
16	54.07	14	43.67	Refraction, &c. &c. + 2.58
18	54.35	17	43.78	
20	54.25	19	43.3	Zenith Distance . . 2 36 52.07
24	54.93	23	42.86	
26	55.2	25	44.	
28	56.23	27	43.65	
30	55.88	29	42.93	
May 3	57.09	May 2	42.53	
6	53.68	5	44.47	
		7	44.75	
Mean	2 36 55.24	Mean	2 36 43.74	

REGULUS.

1809.	Left Arc.	1809.	Right Arc.	MEAN.
April 13	4 45 26.48	April 12	4 45 16.40	4 45 19.26
16	23.68	14	14.29	Refraction, &c. &c. + 4.83
18	26.19	17	14.12	
24	23.32	20	13.07	Zenith Distance . . 4 45 24.09
26	24.2	25	14.89	
28	23.94	27	12.5	
30	25.07	29	11.89	
May 3	26.14	May 2	12.2	
6	24.95	5	12.26	
8	25.83	7	13.89	
Mean	4 45 24.98	Mean	4 45 13.55	

θ LEONIS.

1809.	Left Arc.	1809.	Right Arc.	MEAN.
April 18	8 19 60.72	April 17	8 19 49.31	8 19 54.97
20	60.54	19	52.5	Refraction, &c. &c. + 8.47
24	60.19	23	47.27	
26	62.99	25	46.59	Zenith Distance . . 8 20 3.44
29	57.71	28	48.31	
May 3	62.48	30	48.14	
5	63.54	May 4	48.51	
7	61.75	6	48.96	
Mean	8 20 1.24	Mean	8 18 48.70	

β LEONIS.

1809.	Left Arc.	1809.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 13	7 30 11.98	April 12	7 29 57.57	7 30 3.97
16	8.57	14	60.38	Refraction, &c. &c. + 7.61
18	6.26	17	55.61	
20	7.55	19	59.28	Zenith Distance ∴ 7 30 11.58
24	8.91	23	59.51	
26	9.21	25	60.31	
29	11.91	28	59.01	
May 2	11.71	30	55.80	
4	10.41	May 5	56.56	
6	11.21	7	57.72	
Mean	7 30 9.77	Mean	7 29 58.17	

ε VIRGINIS.

April 18	3 51 7.8	April 19	3 50 57.09	3 51 2.04
20	5.99	23	56.69	Refraction, &c. &c. + 3.91
25	5.86	26	56.25	
28	8.17	29	56.07	Zenith Distance .. 3 51 5.95
30	8.97	May 3	57.51	
May 4	7.79	5	56.18	
6	6.44	7	57.81	
Mean	3 51 7.29	Mean	3 50 56.78	

δ SERPENTIS.

April 18	3 2 28.72	April 19	3 2 17.98	3 2 22.41
20	27.01	23	18.02	Refraction, &c. &c. + 2.95
24	26.9	25	17.27	
26	26.14	27	17.02	Zenith Distance .. 3 2 25.36
28	29 02	29	16.76	
30	29.01	May 3	15.22	
May 5	28.19	6	16.29	
7	28.15			
Mean	3 2 27.89	Mean	3 2 16.94	

α SERPENTIS.

1809.	Left Arc.	1809.	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
April 19	1 6 42.88	April 18	1 6 32.67		1 6 37.16
23	40.53	20	31.85	Refraction, &c. &c.	+ 0.94
25	43.09	24	32.74		
27	43.19	26	31.7	Zenith Distance ..	1 6 38.10
29	43.66	28	31.67		
May 3	43.0	30	30.53		
6	42.35	May 5	31.48		
		7	30.48		
Mean	1 6 42.67	Mean	1 6 31.64		

γ SERPENTIS.

April 18	8 8 43.69	April 19	8 8 33.69		8 8 39.02
20	43.3	23	31.23	Refraction, &c. &c.	+ 7.95
24	43.46	25	32.69		
26	46.66	27	33.75	Zenith Distance ..	8 8 46.97
28	45.85	29	32.19		
May 30	46.28	May 3	33.28		
6	45.53	7	34.73		
Mean	8 8 44.97	Mean	8 8 33.08		

α HERCULIS.

April 15	6 27 49.39	April 16	6 27 36.28		6 27 41.74
17	49.04	18	37.05	Refraction, &c. &c.	+ 6.61
19	47.28	21	34.65		
23	47.25	24	34.87	Zenith Distance ..	6 27 48.35
25	46.96	26	35.95		
27	48.31	28	34.65		
29	48.49	30	34.2		
Mean	6 27 48.10	Mean	6 27 35.38		

α OPHIUCHI.

1809.	Left Arc.	1809.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 13	4 33 14.4	April 12	4 32 61.86	4 33 7.14
15	13.57	14	62.8	Refraction, &c. &c. + 4.72
17	12.85	16	60.96	
19	13.25	18	62.73	Zenith Distance ..4 33 11.86
21	12.00	20	59.5	
24	10.03	23	59.61	
27	12.57	25	61.35	
28	13.93	26	61.71	
30	13.63	29	61.78	
Mean	4 33 12.91	Mean	4 33 1.37	

ε AQUILÆ.

April 13	5 25 32.5	April 28	5 25 16.42	5 25 23.88
29	31.28	30	16.87	Refraction, &c. &c. + 5.37
May 1	32.35	May 3	14.55	
6	30.71	8	16.37	Zenith Distance ..5 25 29.25
Mean	5 25 31.71	Mean	5 25 16.05	

γ AQUILÆ.

April 28	1 59 23.65	April 29	1 59 15.89	1 59 17.76
May 4	22.06	May 3	11.83	Refraction, &c. &c. + 2.01
7	20.35	6	14.51	
		9	11.79	Zenith Distance ..1 59 19.77
Mean	1 59 22.02	Mean	1 59 13.50	

ATAIR.

1809.	Left Arc.	1809.	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
April 28	0 12 21.89	April 29	0 12 10.83		0 12 14.68
30	21.13	May 3	8.82	Refraction, &c. &c.	+ 0.01
May 4	19.68	6	8.16		
7	18.48	9	8.41	Zenith Distance ..	0 12 14.69
Mean	0 12 20.29	Mean	0 12 9.06		

β AQUILÆ.

May 3	2 13 50.42	April 28	2 13 42.5		2 13 46.03
6	51.59	May 4	40.57	Refraction, &c. &c.	+ 2.37
9	49.55				
				Zenith Distance ..	2 13 48.40
Mean	2 13 50.52	Mean	2 13 41.54		

β DELPHINI.

May 6	5 45 59.92	May 7	5 45 46.13		5 45 52.53
9	57.95			Refraction, &c. &c.	+ 5.75
Mean	5 45 58.93	Mean	5 45 46.13	Zenith Distance ..	5 45 58.28

8. *AMPLITUDE*

Of the Arc between *Putchapolliam* and *Punnae.*

STARS.	ZENITH DISTANCES AT		AMPLITUDE.
	PUTCHAPOLLIAM.	PUNNAE.	
	° ′ ″	° ′ ″	° ′ ″
δ Hydræ ..	4 37 12.65 S.	1 47 1.37 S.	2 50 11.28
ε Hydræ ..	3 52 8.97 S.	1 1 59.31 S.	9.66
α Cancri ..	1 36 32.64 N.	4 26 42.91 N.	10.27
ο Leonis....	0 13 18.16 S.	2 36 52.07 N.	10.23
Regulus ..	1 55 12.99 N.	4 45 24.06 N.	11.07
θ Leonis....	5 29 54.26 N.	8 20 3.44 N.	9.18
β Leonis....	4 39 59.4 N.	7 30 11.59 N.	12.19
ε Virginis ..	1 0 55.2 N.	3 51 5.95 N.	10.75
δ Serpentis..	0 12 14.15 N.	3 2 25.36 N.	11.21
α Serpentis..	3 56 48.46 S.	1 6 38.1 S.	10.36
α Herculis ..	3 37 38.58 N.	6 27 48.35 N.	9.77
α Ophiuchi	1 43 0.69 N.	4 33 11.86 N.	11.17
ε Aquilæ ..	2 35 16.44 N.	5 25 29.25 N.	12.81
γ Aquilæ ..	0 50 50.74 S.	1 59 19.77 N.	10.51
Atair	2 37 54.13 S.	0 12 14.69 N.	8.82
β Aquilæ ..	5 3 55.68 S.	2 13 48.4 S.	7.28
β Delphini	2 55 45.68 N.	5 45 58.28 N.	12.6
		Mean	2 50 10.54

Celestial Arc between the Parallels of

Putchapolliam and *Punnae* Station........2° 50′ 10.″54

Terrestrial Arc............1029100.5 Feet.

Mean length of one degree .. 60473 Fath.

Latitude of the middle point 9° 34′ 44″

9. **Latitude** of *Punnae* Station, at the South Extremity of the Arc, deduced from the foregoing Zenith Distances of Eight principal Stars, whose Declinations and Annual Variations are given in the *Greenwich* Observations for the Year 1802.

STARS.	FOR THE BEGINNING OF 1805.		LATITUDE.
	MEAN DECLINATION.	CORRECT Z. DISTANCE.	
	° ′ ″	° ′ ″	° ′ ″
Regulus	12 54 58.93 N.	4 45 24.09 N.	8 9 34.84 N.
β Leonis	15 39 45.28	7 30 11.59 N.	33.7
α Serpentis	7 3 0.3	1 6 38.1 S.	38.4
α Herculis	14 37 30.96	6 27 48.35 N.	42.61
α Ophiuchi	12 42 50.91	4 33 11.86 N.	39.05
γ Aquilæ	10 8 58.34	1 59 19.77 N.	38.57
Atair	8 21 53.53	0 12 14.69 N.	38.84
β Aquilæ	5 55 52.71	2 13 48.4 S.	41.11
		Mean	8 9 38.39

APPENDIX.

1. AS I am at present uncertain whether the particulars of the northern part of the grand arc have been communicated to the public, I will here subjoin the former conclusions, and combine what was before done with what appears in the preceding paper, in order to inform those readers, who are interested in speculations of this nature, that I have not been remiss in promoting objects of general science, while occupied in the more humble task of correcting the erroneous and imperfect geography of the southern part of the Peninsula. Being in possession of the best *English* instruments, and traversing from sea to sea, through six degrees of latitude, I have always considered the measurement of a meridian arc a necessary part of the general work, as well as an acceptable offering to the mathematician and astronomer; especially at a time when similar performances have been carrying on in *France* and *England*, and at the polar circle. I regret that the whole detailed account cannot now appear under one view, as it would swell a volume to too great a size, or preclude more valuable matter from being admitted. I shall therefore confine myself to the simple results, and combine them with those given in the preceding memoir.

In the arc north of *Putchapolliam* there were three stations of observation, besides the station at *Putchapolliam*, viz.: *Dodagoontah*, in latitude 13° nearly; at *Bomasundrum*, which is nearly 14°; and at *Paughur*, which is upwards of 14° 6′.

	°	′	″
The celestial Arc between *Putchapolliam* and *Dodagoontah* was	2	0	9.79
Between *Putchapolliam* and *Bomasundrum* was	3	0	1.88
Between *Putchapolliam* and *Paughur* was	3	6	37.78

And if to each of these we add 2° 50′ 10″.54, which is the celestial arc between *Punnae* and *Putchapolliam*, we shall have the three following arcs, viz.

	°	′	″
Punnae and *Dodagoontah*..............	4	50	20.33
Punnae and *Bomasundrum*	5	50	12.42
Punnae and *Paughur*	5	56	48.32

The former terrestrial arcs were as follow, viz.

Between *Putchapolliam* and *Dodagoontah* ..727334.6 Feet.
Between *Putchapolliam* and *Bomasundrum*..1088275.8
Between *Putchapolliam* and *Paughur* ....1128472.

Hence, by adding to each of these 1029100.5 feet, we shall have the three terrestrial arcs as follow, viz.

	Feet.		Fathoms.
Punnae and *Dodagoontah* ..	1756435.1	or	292739.2
Punnae and *Bomasundrum* ..	2117376.3	or	352896.
Punnae and *Paughur*	215772.5	or	359595.4

Hence, by comparing the respective arcs, we shall have the mean length of the degree due to the latitudes of their respective middle points, as follows:

ARCS.				
Punnae and *Dodagoontah*....	10	34	49....	60496
Punnae and *Bomasundrum* ..	11	4	44....	60462
Punnae and *Paughur*	11	8	3....	60469

And, as the two latter arcs give the degree nearly the same, and the latitudes of their middle points differing but little, we may take the mean of the two degrees, as due to the mean latitude of the two middle points, and this will give 60465.5 fathoms due to the latitude 11° 6′ 23″.5.

2. In order to obtain a mean result between the observations made at *Dodagoontah*, and those at the stations at *Paughur* and *Bomasundrum*, it will be necessary to determine the ratio of the earth's diameters by using the degree deduced from one or other of these arcs,

and some other degree deduced from recent measurements in northern latitudes. I shall therefore take the degree as given by the observations at *Punnae* and *Dodagoontah*, whose middle point is in 10° 34′ 49″, and use it with that determined by Col. MUDGE, for latitude 52° 2′ 20″, in order to which it will be necessary to obtain formulæ expressing the ratio of the diameters in terms of these degrees, and the latitudes to which they apply. That this may be general, let m and m' denote the meridional degrees in latitudes l and $'l$, and let a and b express the equatorial and polar diameters. Then from conic sections, and the nature of curvature, it is known that $\frac{a^2 \ b^2}{2\sqrt{\text{Cos.}^2\,'l.\,a^2 + \text{Sin.}^2\,'l.\,b^2}\,\rceil\,3}$ is the radius of curvature of the elliptic meridian in latitude $'l$, and $\frac{a^2 \ b^2}{2\sqrt{\text{Cos.}^2\,l.\,a^2 + \text{Sin.}^2\,l.\,b.^2}\,\rceil\,3}$ the radius of curvature in latitude l, on that or any other meridian on the same ellipsoid. And since the degrees are as their radii of curvature, we shall have

$$m' : m :: \frac{a^2 \ b^2}{2\sqrt{\text{Cos.}^2\,'l.\,a^2 + \text{Sin.}^2\,'l\,.\,b.^2}\,\rceil\,3} : \frac{a^2 \ b^2}{2\sqrt{\text{Cos.}^2\,l.\,a^2 + \text{Sin.}^2\,l.\,b.^2}\,\rceil\,3}$$

that is $m' : m :: \sqrt{\text{Cos.}^2\,l.\,a^2 + \text{Sin.}^2\,l.b^2}\,\rceil\,3 : \sqrt{\text{Cos.}^2\,'l.\,a^2 + \text{Sin.}^2\,'l.\,b.^2}\,\rceil\,3$

or $m\frac{2}{3} : m\frac{2}{3} :: \text{Cos.}^2\,l.\,a.^2 + \text{Sin.}^2\,l.\,b^2 : \text{Cos.}^2\,'l.\,a^2 + \text{Sin.}^2\,'l.\,b^2$

which reduced gives $\frac{b}{a} = \left(\frac{\text{Cos}^2\,l - \text{Cos}^2\,'l.\overline{\frac{m'}{m}}\,\rceil\,\frac{2}{3}}{\text{Sin}^2\,'l.\,\overline{\frac{m'}{m}}\,\rceil\,\frac{2}{3} - \text{Sin}^2\,l}\right)^{\frac{1}{2}}$ a general expression for the ratio of the diameters.

Now if $m' = 60820$ fathoms, $m = 60496$ fathoms, and if $'l$ and l be 52° 2′ 20″ and 10° 34′ 49″ respectively, then $\frac{b}{a} = \left(\frac{\text{Cos.}^2\,10^\circ\,34'\,49'' - \text{Cos.}^2\,52^\circ\,2'\,20''\,\overline{\frac{60820}{60496}}\,\rceil\,\frac{2}{3}}{\text{Sin.}^2\,52^\circ\,2'\,30''\,\overline{\frac{60820}{60496}}\,\rceil\,\frac{2}{3} - \text{Sin.}^2\,10^\circ\,34'\,49''}\right)^{\frac{1}{2}} = \frac{1}{1.0030359}$ nearly, which call $\frac{1}{1+e}$, e being the ellipticity .0030359.

3. Having obtained the ratio of the diameters to each other, let the length of a degree on such a spheroid be computed for latitude 11° 6′ 23″.5. Then, to get the formula from what is just demonstrated, we have

$$\frac{1}{1+e} = \left(\frac{\text{Cos.}^2\,l - \text{Cos.}^2\,'l.\overline{\frac{m'}{m}}\,\rceil\,\frac{2}{3}}{\text{Sin.}^2\,'l.(\frac{m}{m})\frac{2}{3} - \text{Sin.}^2\,l}\right)^{\frac{1}{2}} \text{ or } \frac{1}{\overline{1+e}\,\rceil^2} = \frac{\text{Cos.}^2\,l - \text{Cos.}^2\,'l.\,(\frac{m'}{m})\frac{2}{3}}{\text{Sin.}^2\,'l.(\frac{m'}{m})\frac{2}{3} - \text{Sin.}^2\,l}$$

which reduced gives $m' : m :: \sqrt{\overline{\text{Cos.}^2 l. (1+e.)^2 - \text{Sin.}^2 l.}|^3} : \sqrt{\overline{\text{Cos.}^2 {}'l. (1+e.)^2 - \text{Sin.}^2 l.}|^3}$ and if $m = 60496$ fathoms, and l, $'l$ be 10° 34′ 49″ and 11° 6′ 23″.5 respectively, we have $m' = 60496 \left(\frac{\text{Cos.}^2(10°34'49'').\overline{1.003036}|^2 - \text{Sin.}^2 10°34'49''}{\text{Cos.}^2(11°6'23''.5).\overline{1.003036}|^2 - \text{Sin.}^2 11°6'23''.5}\right)^{\frac{3}{2}}$ $= 60498$ fathoms, for the meridional degree in latitude 11° 6′ 23″.5, on the ellipsoid, whose polar is to its equatorial diameter as 1 to 1.003036; and this I call the degree in that latitude resulting from the arc *Punnae* and *Dodagoontah*. But the degree in the same latitude, deduced from the arcs *Punnae* and *Paughur*, *Punnae* and *Bomasundrum* (1) is 60465.5 nearly, which must therefore apply to a different ellipsoid. But the mean between this and 60498 is $60486\frac{3}{4}$; or, to avoid fractions, we may take 60487 fathoms for the length of the degree in latitude 11° 6′ 24″, or the mean length of the degree for the arc 5° 53′ 30″, whose middle point is in latitude 11° 6′ 24″. Hence, by substituting 60487 for m, and 11° 6′ 24″ for l, in the formula given in article 2, and retaining the rest of the data, we get $\frac{b}{a} = \frac{1}{1.003143}$, which gives the ellipticity resulting from the measurements in *England* and in *India*, $\frac{1}{318.13}$ nearly.

Since $m' : m :: \sqrt{\overline{\text{Cos.}^2 l (1+e)'^2 - \text{Sin.}^2 l.}|^3} : \sqrt{\overline{\text{Cos.}^2 l. (1+e)^2 - \text{Sin.}^2 l.}|^3}$ and $m = m' \left(\frac{\text{Cos.}^2 {}'l. (1+e)^2 - \text{Sin.}^2 {}'l}{\text{Cos.}^2 l. (1+e)^2 - \text{Sin.}^2 l}\right)^{\frac{3}{2}}$ and if $'l = 50° 2' 20''$, $m = 60820$ fathoms, and $1 + e, = 1.003143$; then, by substituting for l the latitudes 8° 30′, 9° 30′, 10° 30′, 11° 30′, &c. we shall obtain the value of m for these respective latitudes, as follows:

l. ° ′	*m.*	
8 30	60479	Nearly.
9 30	60481	
10 30	60484	
11 30	60488	
12 30	60492	
13 30	60497	

Latitudes of the great stations of observation, as deduced from the above measures of degrees.

	°	′	″
Latitude of *Punnae* station, as determined in Art. 9.	8	9	38.39
Latitude of *Putchapolliam* station................	10	59	47.47
Latitude of *Dodagoontah* station................	13	0	1.9

The latitude of *Dodagoontah*, by the observations in 1805, was 12° 59′ 59″.91, which is less by nearly 2″ than the latitude here given. The latitude of the observatory at *Madras*, as deduced from that of *Dodagoontah*, determined in 1805, was 13° 4′ 8″.7. Hence, if the present latitude be made use of, it will give the latitude of the observatory at *Madras* 13° 4′ 11″ nearly.

4. The late measurements from *Dunkirk* to *Barcelona*, by the *French* mathematicians, gave the length of the degree 60783 fathoms nearly, for the latitude 46° 11′ 57″; and if this be substituted for m' in the above formula (2), the ratio of the polar to the equatorial diameters will be that of 1 to 1.003370, and therefore the ellipticity $\frac{1}{296.74}$ nearly.

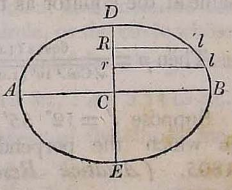
The length of the degree at the polar circle in latitude 66° 20′ 12″, as determined by the members of the *Swedish* academy in 1802 and 3, was found to be 60955 fathoms; and, by substituting this for m' and retaining the rest of the data, we shall have the ellipticity $\frac{1}{311.17}$ nearly. Hence, by reducing these three, the mean ellipticity will be $\frac{1}{308.4}$ nearly, or the polar to the equatorial diameter, as 1 : 1.0032423, the mean result of all the recent measurements.

5. In order to determine the actual values of a and b, let m denote the meridional degree in latitude l, as before, where the radius of curvature is $\frac{a^2 b^2}{2\sqrt{\text{Cos.}^2 l.a^2 + \text{Sin.}^2 l.b^2}|^3}$

and if A denote the arc (57°, &c.) equal radius, we shall have $m\,A = \frac{a^2 b^2}{2\sqrt{\overline{\text{Cos.}^2 l.\,a^2 + \text{Sin.}^2 l.\,b^2}|^3}}$, from which arises $a^2 b^2 = 2\,A\,m\sqrt{\overline{\text{Cos.}^2 l.\,a^2+\text{Sin.}^2 l.\,b^2}|^3}$; and dividing by a^4, we get $\frac{b^2}{a^2} = \frac{2\,A\,m}{a}\left(\text{Cos.}^2 l. + \text{Sin.}^2 l.\,\frac{b^2}{a^2}\right)^{\frac{3}{2}}$; that is $\frac{1}{\overline{1+e}|^2} = \frac{2\,A\,m}{a}\left(\text{Cos.}^2 l. + \text{Sin.}^2 l.\,\frac{1}{\overline{1+e}|^2}\right)^{\frac{3}{2}}$ which being reduced gives $\frac{1}{2}\,a = \frac{m\,A\sqrt{\overline{\text{Cos.}^2 l.\,(1+e)^2+\text{Sin.}^2 l.}|^3}}{1+e}$, the semi-equatorial diameter. Hence, if $m = 60487$, $l = 11°\,6'\,24''$ and $1+e$ equal 1.0032423, and these substituted in the last formula, we shall have $\frac{1}{2}\,a = 3486906$ fathoms; and as $1.0032423 : 1 :: \frac{1}{2}\,a : \frac{\frac{1}{2}a}{1.0032423} = 3475638$ fathoms, equal $\frac{1}{2}\,b$. And since $\frac{1}{2}\,a$ is the radius of the equatorial circle, then $\frac{\frac{1}{2}a}{A} = \frac{3486906}{57.295,\&c.} = 60858$ fathoms, the measure of the degree of longitude at the equator.

6. Since $m' : m :: \sqrt{\overline{\text{Cos.}^2 l. + \frac{1}{\overline{1+e}|^2}\,\text{Sin.}^2 l.}|^3} : \sqrt{\overline{\text{Cos.}^2 {}'l. + \frac{1}{\overline{1+e}|^2}\,\text{Sin.}^2 {}'l.}|^3}$ (3); and when m is at the equator, and therefore $\text{Sin.}^2 l. = o$ and $\text{Cos.}^2 l = 1$ (Rad.) then $m' : m :: \overline{1+e}|^3 : \sqrt{\overline{\text{Cos.}^2 {}'l.(1+e)^2+\text{Sin.}^2 {}'l}|^3}$, and $m = \frac{m'\sqrt{\overline{\text{Cos.}^2 {}'l.\,(1+e)^2 + \text{Sin.}^2 {}'l.}|^3}}{\overline{1+e}|^3} = \frac{60487\sqrt{\overline{\text{Cos.}^2 (11°\,6'\,24'')\,.\,\overline{1.0032423}|^2 + \text{Sin.}^2\,11°\,6'\,24''}|^3}}{\overline{1.0032423}|^3} = 60465$ fathoms, the measure of the meridional degree at the equator.

7. Let d and $'d$ be the measures of two degrees of longitude in the latitudes of l and $'l$, then $r\,l$ and $R\,'l$ will represent the radii of curvature d and $'d$ respectively. But $R\,'l$ is expresssed by



$\frac{a^2 \text{Cos.}^2 \,'l}{2\sqrt{\text{Cos.}^2 \,'l\, a^2 + \text{Sin.}^2 \,'l.\, b}} = \frac{a^2}{2\sqrt{a^2 + \text{tang.}^2 \,'l.\, b^2}}$ and for the same reason $r\ l = \frac{a^2}{2\sqrt{a^2 + \text{tang.}^2\, l.\, b^2}}$. Hence $\frac{a^2}{2\sqrt{a^2 + \text{tang.}^2\, l.\, b^2}}$: $\frac{a^2}{2\sqrt{a^2 + \text{tang.}^2 \,'l.\, b^2}} :: d : 'd$ or $\sqrt{a^2 + \text{tang.}^2\, l.\, b^2} : \sqrt{a^2 + \text{tang.}^2\, l. b^2}$ $:: d : 'd$, that is $\sqrt{\overline{1+e}|^2 + \text{tang.}^2 \,'l} : \sqrt{\overline{1+e}|^2 \text{tang.}^2\, l.} ::$ $d : 'd$. And when d is at the equator, and therefore tang.^{2} $l = o$; then $\sqrt{\overline{1+e}|^2 + \text{tang.}^2 \,'l} : 1+e :: d : 'd$; and therefore $'d = \frac{d\,(1+e)}{\sqrt{\overline{1+e}|^2 + \text{tang.}^2 \,'l}}$ a general formula. Let $l = 10°$, $d = 60858$ fathoms, as in article 5, and $1+e$ as before; then $'d = \frac{60858\ (1.003242)}{\sqrt{\overline{1.003242}|^2 + \text{tang.}^2\, 10°}} = 59940$. From this formula a table of degrees of longitude on this spheroid may be computed, from the equator to the pole.

8. Let p be the degree perpendicular to the meridian in latitude l, and p' that in latitude l'. Then, these being as their respective verticals or radii of curvature, we have $p : p' :: \frac{a^2}{2\sqrt{\text{Cos.}^2 l.a^2 + \text{Sin.}^2 l.b^2}} : \frac{a^2}{2\sqrt{\text{Cos.}^2 l'.\, a^2 + \text{Sin.}^2 \,'l.\, b^2}}$ that is $p : p' :: \sqrt{\text{Cos.}^2 l'.a^2 + \text{Sin.}^2 l' b^2} : \sqrt{\text{Cos.}^2 l.a^2 + \text{Sin.}^2 l.b^2}$; that is $p : p' :: \sqrt{\text{Cos.}\ 'l (1+e)^2 + \text{Sin.}\ 'l} : \sqrt{\text{Cos.}^2 l.(1+e)^2 + \text{Sin.}^2 l}$; and when p is at the equator, and therefore Sin.^{2} $l = o$, and Cos.^{2} $l = 1$ (Rad.) then $p : p' :: \sqrt{\text{Cos.}^2 l.(1+e)^2 + \text{Sin.}^2 \,'l} :$ $1+\text{e}$. Hence $p' = \frac{p.(1+e)}{\sqrt{\text{Cos.}^2 \,'l.(1+e)^2 + \text{Sin.}^2 \,'l.}}$

Then if $l' = 10°$, and $p = 60858$ fathoms, being the same at the equator as the degree of longitude d.

$$\text{Then } p' = \frac{60858\ (1.003242)}{\sqrt{\text{Cos.}^2\, 10°\, (1.003242)^2 + \text{Sin.}^2\, 10°}} = 60863 \text{ fathoms.}$$

Suppose $l' = 12°\ 55'\ 10''$, which was the latitude in which the perpendicular arc was measured in 1805. (*Asiatick Researches*, Volume 10.) Then

$$p' = \frac{60858 \quad (1.003242)}{\sqrt{\text{Cos.}^2 (12^\circ\, 55'\, 10''). \ (1.003242)^2 + \text{Sin.}^2 (12^\circ\, 55'\, 10'')}} = 60869$$
fathoms, which exceeds the degree given by the measured arc by 121 fathoms.

The perpendicular degree determined by the arc between *Carangooly* and *Karnatighur*, in 1802, (see *Asiatick Researches*, Volume 8,) was 61061 fathoms for latitude 12° 32′ 12″. Now the mean between this and the perpendicular degree, measured in 1805, for latitude 12° 55′ 10″, will be 60909 fathoms, and the mean of the latitudes will be 12° 48′ 41″; which latitude being substituted in the above, we shall have the value of $p' = 60868$ fathoms, which falls short of the above mean 41 fathoms: but how far this mean may be relied on is yet a matter of uncertainty, for I never had much confidence in the accuracy of the perpendicular arc measured in 1802.

9. From the formula in the two last articles, it appears that the perpendicular degree p', and the degree of longitude $'d$, in any latitude $'l$, will be to each other as $\frac{1}{\sqrt{\text{Cos.}^2 l'. (1+e)^2 + \text{Sin.}^2 l'.}} : \frac{1}{\sqrt{(1+e)^2 + \text{tang.}^2\, 'l.}}$ because p and d are equal at the equator. Hence, $p' : {}'d :: \sqrt{(1+e)^2 + \tan.^2\, 'l} :$ $\sqrt{\text{Cos.}^2\, 'l\, (1+e)^2 + \text{Sin.}^2\, 'l}$ and $'d = p' \left(\frac{\overline{1+e}|^2 . \text{Cos.}^2\, 'l + \text{Sin.}^2\, 'l}{\overline{1+e}|^2 + \text{tang.}^2\, 'l} \right)^{\frac{1}{2}}$ whence p' being known, $'d$ may be found.

10. The equatorial diameter of this ellipsoid has already been shewn to be 6973812 fathoms (5) $= a$, the transverse axis of an elliptic meridian, and therefore the periphery of the circumscribing circle, or the circle whose diameter is a, will be $a \times 3.1415$ &c. and if $d = 1 - \frac{b^2}{a^2}$, then $1 : 1 - \frac{d}{2^2} - \frac{3d^2}{2^2.4^2}$ &c. :: $a \times 3.1415$ &c. : $a \times 3.1415$ &c. $(1 - \frac{d}{2^2} - \frac{3d^2}{2^2.4^2}$ &c.$)$ = the periphery of the elliptic meridian: hence $\frac{6973812 \times 3.1415 \text{ \&c.} (1 - \frac{d}{2^2} - \frac{3d^2}{2^2.4^2} \text{ \&c.})}{4} = 5465790$

fathoms for the length of the quadrantal arc: and this reduced to inches and divided by 10.000000 will give 39.3537 *English* inches for the measure of the *French* metre at the temperature of 62°.

By BORDA's experiments, the equivalent to the *French* metre in *English* inches is 39.371, the standard temperature of the metre being at 32°, and that of the *English* at 62°, so that the metre, according to this ellipsoid, falls short of that given by the *French* mathematicians, near $\frac{17}{100}$th of an *English* inch, or $\frac{1}{25}$th of a *French* line, and the quadrantal arc will fall short 2403 fathoms, or $10\frac{121}{165}$ miles, in the whole circumference.

10. *Latitudes and Longitudes*

Of the great Stations, and some principal Places, as deduced from the Meridional Arc.

NAMES OF PLACES.	Latitudes.			Longitudes from Madras Observatory.				Longitudes from Greenwich.			
	°	′	″	°	′	″		°	′	″	
* Shennimalli	11	9	27	2	39	58	W.	77	38	42	E.
* Yaëlmatoor hill	11	12	6	2	30	12		77	48	18	
* Hallagamalli	11	0	52	2	48	54		77	29	36	
* Kantpolliam, *(or S. E. End of the Base)*	10	56	43	2	34	22		77	44	8	
* Putchapolliam Station	10	59	47	2	37	47		77	40	43	
* Parmatty hill	10	58	31	2	19	48		77	58	42	
* Parteemalli	10	40	2	2	40	35		77	37	55	
Rungamalli	10	38	56	2	20	8		77	58	22	
* Kurroomalli	10	35	26	2	22	39		77	55	51	
Darapooram, *(Fort)*	10	44	34	2	43	13		77	35	17	
Pyney hill and Pagoda	10	26	22	2	43	58		77	34	32	
* Permaul hill	10	18	1	2	41	20		77	37	10	
* Rissheemalli	10	12	34	2	22	12		77	56	18	
Dindigul, *(Flag Staff)*	10	21	38	2	17	21		78	1	9	
* Nagamalli	10	0	1	2	18	54		77	59	36	
* Suddragherry	9	44	26	2	34	34		77	43	56	
Madura, *(N. E. Pagoda)*	9	55	15	2	7	52		78	10	38	
* Sekundermalli	9	52	37	2	10	57		78	7	33	
* Kooteapára	9	28	52	2	14	33		78	3	57	
* Meenachiporam hill	9	12	39	2	16	23		78	2	7	
* Perinoormalli	9	12	21	2	45	29		77	33	1	
* Gopaulswamy hill	9	39	24	2	27	13		77	51	17	
Shevelipootoor *(Pagoda)*	9	30	36	2	37	13		77	41	17	
Sungarnacoil *(Pagoda)*	9	10	18	2	43	12		77	35	18	
* Vullunkota hill	8	48	23	2	37	45		77	40	45	
Yettiaporam, *(or Eliapoor Palace)*	9	8	57	2	15	16		78	3	14	
* Kolanelloor hill	8	55	39	2	16	14		78	2	16	
Tutacorin, *(Flag-Staff)*	8	48	0	2	5	40		78	12	50	
* Vullanaud hill	8	42	54	2	22	3		77	56	27	
Palamcottah, *(Flag-Staff)*	8	43	31	2	30	56		77	47	34	
Tinnivelly, *(Pagoda)*	8	43	45	2	33	51		77	44	39	
* Coonatoor hill	8	41	52	2	34	48		77	43	42	
* West end of the Base	8	47	6	2	36	33		77	41	57	
* East end of the Base	8	46	21	2	31	32		77	46	58	
* Taulaootpotha	8	49	1	2	31	47		77	46	43	
* Kunnimapotha	8	30	28	2	37	49		77	40	41	
* Red hill Station	8	22	39	2	22	49		77	55	41	
Tirchundoor, *(Pagoda)*	8	29	50	2	7	23		78	11	7	
* Koodunkolum	8	10	34	2	34	30		77	44	0	
* Munpotha	8	16	2	2	40	37		77	37	53	
Kalcaud, *(Pagoda)*	8	31	1	2	42	7		77	36	23	
Nagalancherri	8	29	34	2	35	41		77	42	49	
* Punnae Station	8	9	37	2	37	39		77	40	51	
Kootapooli, *(Romish Church)*	8	8	51	2	39	8		77	39	22	

Note. All Places marked with the Asterisk (*) are great Stations.

11. *Elevations and Depressions.*

Contained Arcs, Terrestrial Refractions, together with the Heights, above the Level of the Sea, of the principal Stations.

Stations at	Stations observed.	Apparent Elevations and Depressions.	Contained Arcs.	Refraction.	Elevation above the Sea. Stations.	Elevation above the Sea. Heights.
		° ′ ″	′ ″			FEET.
S.E. end of the Base	Parteemalli	0 4 42 E.	17 45	$\frac{1}{13}$	Parteemalli	1308.4
Parteemalli	Kautpolliam........	0 19 49 D.				
S.E. end of the Base	Parmatty hill	0 8 7 D.	14 24	$\frac{1}{18}$	Parmatty hill	880.1
Parmatty hill	S.E. end of the Base	0 4 34 D.				
S.E. end of the Base	Hallagamalli	0 11 49 E.	14 52	$\frac{1}{17}$	Hallagamalli	1407.6
Hallagamalli........	S.E. end of the Base	0 24 54 D.				
Parteemalli	Permaul hill........	2 26 28 E.	22 2	$\frac{1}{15}$	Permaul hill........	7367.6
Parteemalli	Kurroomalli........	0 32 42 E.	18 13	$\frac{1}{14}$	Kurroomalli........	2612.2
Kurroomalli........	Parteemalli	0 48 20 D.				
Kurroomalli........	Rissheemalli........	0 31 9 D.	22 52	$\frac{1}{14}$	Rissheemalli........	1759.8
Rissheemalli........	Kurroomalli........	0 11 13 E.				
Rissheemalli........	Nagamalli	0 34 2 D.	12 58	$\frac{1}{11}$	Nagamalli	1105.8
Nagamalli	Rissheemalli........	0 23 17 E.				
Rissheemalli........	Suddragherry	0 32 24 E.	30 39	$\frac{1}{12}$	Suddragherry	4219.6
Suddragherry	Rissheemalli........	0 58 44 D.				
Suddragherry	Permaul hill........	0 37 54 E.	34 14	$\frac{1}{12}$	Permaul hill........	7359.3
Suddragherry	Perrioormalli	1 1 16 D.	33 49	$\frac{1}{12}$	Perrioormalli	1429.
Perrioormalli	Suddragherry	0 32 28 E.				
Nagamalli	Sekundermalli......	0 2 6 D.	10 46	$\frac{1}{5}$	Sekundermalli......	1121.
Sekundermalli......	Nagamalli	0 3 42 D.				
Sekundermalli......	Gopaulswamy	0 28 21 D.	20 47	$\frac{1}{8}$	Gopaulswamy	747.8
Gopaulswamy	Sekundermalli......	0 2 23 E.				
Sekundermalli......	Kooteapara	0 26 3 D.	24 0	$\frac{1}{8}$	Kooteapara	412.1
Kooteapara	Sekundermalli......	0 7 32 E.				
Perrioormalli	Meenachiporam	0 32 57 D.	28 44	$\frac{1}{10}$	Meenachiporam	344.1
Meenachiporam	Perrioormalli	0 9 47 E.				
Meenachiporam	Kolanelloor hill	0 4 54 D.	17 0	$\frac{1}{7}$	Kolanelloor hill	376.5
Kolanelloor hill	Meenachiporam hill	0 7 5 D.				
Kolanelloor hill	Vullanaud hill......	0 22 35 E.	13 59	$\frac{1}{7}$	Vullanaud hill......	1051.7
Vullanand hill......	Kolanelloor hill	0 32 16 D.				
Perrioormalli	Vullunkota	0 28 56 D.	25 8	$\frac{1}{9}$	Vullunkota	591.7
Vullunkota	Perrioormalli	0 8 54 E.				
Vullunkota	Coonatoor hill......	0 9 58 D.	7 9	$\frac{1}{9}$	Coonatoorpotha	496.9
Coonatoor hill......	Vullunkota hill	0 5 5 E.				
Vullunkota	West end of the Base	1 47 11 D.	1 45	$\frac{1}{7}$	West end of the Base	263.3
West end of the Base	Vullunkota	1 45 57 E.				
Vullunkota	East end of the Base	0 41 8 D.	6 29	$\frac{1}{4}$	East end of the Base	145.1
East end of the Base	Vullunkota	0 36 54 E.				

Stations at	Stations observed.	Apparent Elevations and Depressions	Contained Arcs.	Refraction.	Elevation above the Sea.	
					Stations.	Heights.
		° ′ ″	′ ″			FEET.
Vullanaud hill......	Taulaootpotha......	0 28 15 D.	11 23	1/5	Taulaootpotha......	538.9
Taulaootpotha......	Vullanaud hill......	0 22 17 E.				
Vullunkota	Kunnimapotha......	0 2 59 D.	17 55	1/8	Kunnimapotha	708.9
Kunnimapotha......	Vullunkota	0 10 25 D.				
Kunnimapotha	Kullikolum hill	0 17 22 D.	9 42	1/6	Kullikolum hill	464.4
Kullikolum	Kunnimapotha......	0 11 15 E.				
Kullikolum	Red hill Station	0 15 15 D.	12 42	1/11	Red hill Station	236.
Red hill Station	Kullikolum	0 5 6 E.				
Red hill Station	Koodunkolum	0 8 43 D.	16 43	1/9	Koodunkolum	165.8
Koodunkolum	Red hill Station	0 3 58 D.				
Koodunkolum	Punnae Station	0 19 58 D.	3 15	1/4	Punnae Station	55.
Punnae Station	Koodunkolum	0 18 41 E.				
Punnae Station above the low-water mark by measurement................						44.8
Difference or Error................						10.2

II.

On the Malâyu Nation, with a Translation of its Maritime Institutions.

BY THOMAS RAFFLES, ESQ.

THE opinion that the *Malays* possess no records whatever of their laws and customs, and that they are solely governed by long-established customs and usages, handed down by memory or tradition, seems to have been much strengthened by the observations contained in MARSDEN's Account of *Sumatra*. This being the only standard book in the *English* language, which contains a detailed account of any of the eastern isles, appears by many to have been considered as applying, generally, to all the countries denominated *Malayan*, whereas the island of *Sumatra*, though exhibiting an almost inexhaustible fund for research and inquiry, can only be considered as one of the almost innumerable islands, and by no means the greatest in population or in extent, which compose that unparalleled *Archipelago* in which the *Malâyu* nation is established.

The island of *Sumatra*, as well as the islands of *Jawa*, *Tana Ugi* or *Bugis* land (*Celebes*), *Súlu*, and the *Moluccas*, which with *Borneo* compose what may be properly termed the *Malayan group*, are peopled by nations radically distinct from the *Malays*, who speak languages entirely different, and use various written cha-

racters, original and peculiar to each. These nations are governed by their several laws and institutions; and if we except the state of *Menangcábaw*, on the island of *Sumatra*, it is on the shores of these islands only, and in the *Malay* peninsular, that the *Malays* are to be found. Whatever may have been the origin of the *Maláyu* nation, the primary population of these various and extensive islands could never, according to any natural inference, have proceeded from the *Malays*, though the reverse may probably have been the case, whatever may have been borrowed from a more foreign source.

Notwithstanding, therefore, the idea of Mr. MARSDEN*, that the various dialects of the *Maláyu* tongue have experienced such changes, with respect to the purposes of intercourse, that they may be classed into several languages differing considerably from each other, I cannot but consider the *Maláyu* nation as one people, speaking one language, though spread over so wide a space, and preserving their character and customs, in all the maritime states lying between the *Súlu* seas, and the Southern Ocean, and bounded longitudinally by *Sumatra*, and the western side of *Papua*, or *New Guinea*.

The *Maláyu* language may no doubt be traced to a still further extent, and particularly among the South-Sea islands; but as that point more naturally belongs to a dissertation on the origin of the nation and its language, it need not be attended to here, where the subject is only alluded to in order to fix those boundaries to which the *Maláyu* law extends, and for establishing such distinctions and general definitions as may assist in its explanation, and more ready comprehension.

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* MARSDEN on the Traces of the *Hindu* Languages and Literature, Page 223, Vol. 4, *Asiatick Researches*.

The laws and customs of the *Malays* may be considered either separately, or as they have reference to those of the more ancient and original inhabitants of the eastern islands, with whom they are now so intimately connected. What may be termed the proper laws and customs of the *Maláyu* nation, as it at present exists, will first be adverted to.

Independent of the laws of the *Korán*, which are more or less observed in the various *Malay* states, according to the influence of their *Arabian* and *Muhammedan* teachers, but seldom further than they affect matters of religion, marriage, and inheritance, the *Malay* states possess several codes of laws, denominated *Undang Undang*, or *Institutions*, of different antiquity and authority, compiled by their respective sovereigns; and every state of any extent possesses its own *Undang Undang*. Throughout the whole there appears a general accordance; and, where they differ, it is seldom beyond what situation, superior advantages, and authority, have naturally dictated. Many of the *Undang Undang* contain the mere regulations for the collection of the duties for trade, and the peculiar observations of the port; while others ascend to the higher branches of civil and criminal law.

From the comparatively rude and uncivilized character of the *Malay* nation, neither learned disquisition nor very close coincidence is to be looked for; but simple ideas, simply expressed, may illustrate character better than scientific arrangement or refined composition. And in this point of view, however local or particular the subject may be, the institutions and regulations of so extensive a maritime nation must be interesting.

Considering, therefore, that a translation of these codes, digested and arranged according to one general plan, might be as useful in facilitating and ensuring a

more secure intercourse, among this extraordinary and peculiar nation, as it might be interesting in illustrating the unjustly degraded character of so extensive a portion of the human race, hitherto so little known either with respect to what they are or what they were; I have long been engaged, as far as the severe duties of my public situation would admit, in collecting *Malay* manuscripts of every description, and, in particular, copies of the *Undang Undang Maláyu*, which, with the various collections of *Addat*, or immemorial customs, and what may be usefully extracted from the *Sejáreh Maláyu*, and *Akal Maláyu*, or annals and traditions of the *Malays*, comprise what may be termed the whole body of the *Malay* laws, customs, and usages, as far as they can be considered as original, under the heads of government, property, slavery, inheritance, and commerce.

On the eastern side of *Sumatra*, the *Malay* states of *Achí*, *Siác*, and *Palembang*, may be considered as of the most importance. From these states I have procured one copy of the *Undang Undang Achí*, with a short account of the *Undang Undang Siác*. Further copies of these, as well as of the institutions of *Palembang*, I have reason to believe are within my reach.

The laws of *Achí* are peculiar, on account of the severity of the criminal law; and although it may be presumed that they were borrowed from the more ancient inhabitants of the island, they are interesting, in as far as they may have been generally adopted by the *Malays* in the Straits of *Maláca*, and may have given rise to that sanguinary disposition by which the *Malays* are usually supposed to be characterized.

Those of *Siác* have a peculiar interest, from the long-established connexion between that state and the *Menangcábaws*, in the interior of *Sumatra*. The *Siác* river takes its rise in the *Menangcábaw* country, and has

obviously been the principal outlet from the rich and pupulous countries in the interior, of which so little is known.

The *Malay* customs and usages on the west coast of *Sumatra* I apprehend to be so much blended with those of the more original inhabitants of the island, that, even if there was a state among them of sufficient importance to have its own institutions, it would scarcely deserve consideration, in the general arrangement of what is purely *Malayan*, and they are consequently little attended to.

Of the *Malay Peninsula*, the principal states entitled to notice on the western side are those of *Kedeh*, *Maláca*, and *Johór*; and, on the eastern, those of *Tringáno*, *Patáni*, and *Pahang*. From these I have obtained and collected several copies of the *Undang Undang Kedeh*, the *Undang Undang Maláca*, and the *Undang Undang Johór*. The states on the eastern side of the peninsula, with the exception of *Patáni*, which has been considerably influenced by the *Siamese*, seem generally to have admitted the superiority of the *Malay* government, first established at *Sínhapúra*, and afterwards at *Johór*.

On the island of *Borneo*, the several *Malay* states have regulations and institutions peculiar to each, though not differing in any material degree from those of the peninsula. Some of these I have already obtained in whole, and others in part.

The *Maláca* code, stated to have been compiled during the reign of Sultan MUHAMMED SHAH, of which I have three copies, treats principally of commercial and maritime usages, and in these branches may form the text of a *Digest of the Malay Laws*; whilst the institutions of *Johór*, from the intimate connexion which appears

always to have existed between *Maláca* and the southern part of the peninsula, may be useful as a supplement on these points; at the same time that it will branch out into civil and criminal law generally, and the general principles of communication between the different states.

The *Kedeh* code may, in like manner, form the text for such parts of the institutions as may be most applicable to the intercourse of *Europeans*, and tend best to a general understanding of the character and usages of the *Malay* countries in the immediate vicinity of the *British* settlements. This state, until the establishment of the *English* at *Pulaw Pénang*, possessed a respectable commerce, and still retains its *Malayan* government and institutions applicable to internal affairs, though reduced in external importance.

The institutions of the smaller states, as of *Salingór*, *Pérak*, and others, may only require notice as far as they differ from the general code of the superior states.

With respect to the internal regulations of government, police, property, and, what in all *Malay* codes occupies so large a share, slavery, the *Malay* states on the peninsula have been selected, as well on account of their connexion with the *English* government at *Penang* and *Maláca*, as for the still more important reason, in a philosophical point of view, of the *Malays* being, according to the theory I have laid down, to be found here the least adulterated in their character, usages, and manners. They are bounded by the *Siamese* to the north, whose encroachments and establishments in the peninsula, as they have from time to time taken place, may easily be defined. The *Malays* seem here to have occupied a country previously unappropriated; for, if we except an inconsiderable race of *Caffries*, who are occasionally found near the mountains, and a few tribes of the *Orang*

benúa, there does not exist a vestige of a nation anterior to the *Malays* in the whole peninsula.

As the population of the *Malay Peninsula* has excited much interest, my attention has been particularly directed to the various tribes stated to be scattered over the country.

Those on the hills are usually termed *Samang*, and are woolly-headed; those on the plain *Orang benúa*, or people belonging to the country; the word *benúa* being applied by the *Malays* to any extensive country, as *benúa China*, *benúa Keling*; but it appears to be only a sort of *Malay* plural to the *Arabic* word *ben* or *beni*, signifying a tribe. The early adventurers from *Arabia* frequently make mention in their writings of the different tribes they met with to the eastward, and from them most probably the *Malays* have adopted the term *Orang benúa*.

I had an opportunity of seeing two of these people, from a tribe in the neighbourhood of *Maláca*; it consisted of about sixty people, and the tribe was called *Jókóng*. These people, from their occasional intercourse with the villages dependent on *Maláca*, speak the *Maláyu* language sufficiently to be generally understood. They relate that there are two other tribes, the *Orang benúa* and the *Orang Udái*. The former appear the most interesting, as composing the majority; the latter is only another name for the *Samang*, or *Caffries*.

From the vicinity of the *Jókóng* tribe to *Maláca*, and intercourse with its inhabitants, they may have adopted many *Malay* words not originally in their language; but the following short specimen may perhaps tend to illustrate their connexion with the other tribes of the peninsula, and to evince how far they possess a peculiar language. They are not circumcised, and they appear to have

received some instruction regarding *Nabi Isa*, or, as they pronounce it, *Isher*. They, however, have no books, nor any word for GOD, whom they designate by the *Portuguese Déos*. The men are well formed, rather short, resembling the *Malay* in countenance, but having a sharper and smaller nose. They marry but one wife, whether rich or poor, and appear to observe no particular ceremony at their nuptials. The consent of the girl and that of the parents being obtained, the couple are considered as man and wife.

The *Jókóng* language in general coincides with *Malay*, as in the following instances:

Earth,	***Tana.***	Belly,	***Purút.***
Fire,	***Apí.***	Sun,	***Mata hári.***
Fish,	***Ican.***	Mouth,	***Mulút.***
Bird,	***Burung.***	Eye-brow,	***Kening.***
Eye,	***Mata.***	Old,	***Tuha.***
Nose,	***Idung.***	Good,	***Baík.***
Teeth.	***Gigi.***		

The numerals are also the same as in *Malay*.

In the following instances it differs from the *Malay*:

Stars,	***Cheóng.***	House,	***Cheróngüe.***
Moon,	***Hantu jahat.*** The bad spirit.	Arrow,	***Tamian.***
Water,	***Yehó.***	Hair,	***Buluútah.*** Feathers of the head.
Tiger,	***Kahoing.***	Head,	***Utah.***
Dog,	***Koyope.***	Wild hog,	***Chonkokh.***
Bear,	***Sehó.***	Devil,	***Choleng.***
Elephant,	***Brinkil.***	Evil spirit, which blasts the produce of the earth,	***Hantu bilir.***
Rhinoceros,	***Risaki.***		
Arm,	***Wúngún.***		
Foot,	***Tomén.***		
Child,	***Merbodo.***	God,	***Déos.*** Evidently Portuguese.
Infant,	***Opayĕt.***		

As the relation that may have existed between the state of *Menangcábaw*, on the island of *Sumatra*, and

that so called on the *Malay Peninsula*, is not generally known, the following translation of a *Maláyu* MS., to which I give some credit, may tend to elucidate it. The fact related is without date or authority, but it is in a great degree confirmed by the general history of *Johór*, and the present state of the country in the neighbourhood, as well as by the existence at this day of another *Malay* state, of considerable extent, situated in the interior of the peninsula, and deriving its authority from *Menangcábaw* in *Sumatra*. The state alluded to is that of *Rembaw*, inland of *Maláca*, the *Rája* of which, as well as his officers, receive their authority and appointments from *Sumatra*. The communication is carried on in the *Malay Peninsula* through the river *Lingi*, in the neighbourhood of *Maláca*, and that of *Siac*, on the *Sumatra* side. The *Malays* of *Rembaw*, with whom I have had frequent communication, adopt the broad dialect of the *Malays* of *Sumatra*, changing the *á* at the end of a word into *o*; this peculiarity may be still observed among many of the inhabitants of the southern part of the peninsula.

" Many years ago the *Rája* of *Johór* had an only
" daughter, the fame of whose beauty reached the ears of
" the illustrious son of the *Rája* of *Menangcábaw*, whose
" residence is at *Pegarúyung* in *Pulau Pérechek* *, and
" whose power is mighty. The young prince, enamoured
" with the enchanting descriptions of this beauty, entreat-
" ed his father's permission to make a voyage to *Johór*
" for his recreation, and the *Rája* his father was pleased
" to comply with his request.

" The young prince accordingly embarked from the
" shores of *Pulau Pérechek*, attended by a numerous

* The island of Sumatra.

" retinue, suited to his high rank and splendid for-
" tune.

" On the arrival of the *Práhus* or vessels in the
" Straits * of *Johór*, the prince was desirous of imme-
" diately proceeding up the river; but the *Rája* of *Johór*,
" alarmed at the unexpected appearance of so large a
" fleet with a royal standard, refused him admittance.
" The prince, determined on proceeding, entered the river,
" and, being opposed by the *Johór Práhus*, a severe
" battle ensued, in which the men of *Johór* were de-
" feated, and obliged to retreat in confusion.

" On the result of the action being made known to
" the *Rája* of *Johór*, he assembled his nobles and officers
" of state, and advised with them as to the conduct that
" should be pursued. Fearful that the men of *Johór*,
" worsted in the first engagement, might not have power
" or courage to stand in a second, it was the unanimous
" opinion that the prince should be invited to proceed
" up the river on friendly terms; and the prince was
" accordingly invited.

" The prince lost no time in proceeding with his suite
" up the river, and, when he landed from the royal *Práhu*,
" he was received as a *Rája* high in rank. The *Rája*
" of *Johór* then inquired of him the business that had
" brought him to *Johór*, and what were his wishes; to
" which the prince replied, that he was enamoured of his
" daughter, and came to solicit her in marriage. The
" *Rája*, having consulted with his nobles and officers of
" state, agreed to the marriage, and a place was allotted
" for the residence of the prince and his followers. In

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* These Straits are called *Sálat Tebrau*, "the Straits of *Tebrau*;" the continent and country of *Johór* being on one side, and *Pulau Mirambung* on the other.

" a short time the prince was married to the daughter of " the *Rája*, and they lived together in the district that " had been allotted to them, and their happiness in- " creased every day; but how long did this last?

" The prince soon became delighted with his princess, " and so pleased with the attentions of the *Rája* of *Johór*, " and the enclosed village or district allotted to him, " which now bore the name of *Campúng Menangcábaw*, " that he thought not of returning to the territories of " his royal father, but remained in *Johór* with his follow- " ers, many of whom married with the women of *Johór*, " so that their numbers increased daily.

" The *Rája* of *Johór* having afterwards conferred on " the prince the title of *Yang depertúhan kichil*, and in " consequence given him considerable power and autho- " rity in *Johór*, the prince exerted it with great severity. " The increasing consequence of the prince, added to " his severity, alarmed *Rájah* MU'DA of *Johór*, who " assembled all his friends and adherents, who were very " numerous, and consulted with them as to the measures " that should be taken. Hurt and enraged that the " power of government was almost entirely taken out of " the hands of the men of *Johór*, and that a stranger " should assume nearly the whole authority, they respect- " fully submitted the circumstances to the serious consi- " deration of the *Rája*, requesting that the whole of the " *Menangcábaws* might be removed from *Johór*, other- " wise they would be soon enslaved by them.

" The *Rája* listened not to their request, and *Rája* " MU'DA became more enraged. He again assembled " his friends and adherents, and the number of those " who were dissatisfied with the *Menangcábaws* being " allowed to remain in *Johór* became very great. They " unanimously agreed, to the amount of above eight " hundred, to proceed with long *Creeses* into the enclo-

" sure of the *Menangcábaws*, and put them to death. " This resolution being fixed at mid-day, they were desi- " rous of securing from danger the daughter of the *Rája*; " and accordingly, previous to the attack, a few men en- " tered the enclosure at sun-set, unobserved, and brought " the princess in safety to *Rája* MU'DA.

" The prince, entering the apartment in which he " expected to find the princess, searched in vain for her. " Aware of the enmity of *Rája* MU'DA, he instantly as- " sembled all the *Menangcábaw* men. The *Gong* was " sounded, and all were in arms.

" Accompanied by all the *Menangcábaw* men who " were in the enclosure at the time, the prince sallied " forth in search of his princess. No sooner were they " without the enclosure, than *Rája* MU'DA, hearing " their approach, advanced against them; a severe battle " ensued, which lasted from before midnight until day- " light next morning, and in which four hundred of the " men of *Johór* were slain. In the morning the prince " retired within the enclosure of the village, and was closely " followed by the remaining force of *Rája* MU'DA. " These, however, were soon slain to a man by the *Me-* " *nangcábaws*, and *Rája* MU'DA alone escaped with his " life, having taken the precaution of retiring to his house " unobserved before day-light.

" The prince, exasperated at the treacherous conduct " of the men of *Johór*, and offended that the *Rája* should " permit *Rája* MU'DA thus openly to attack him, pro- " ceeded the next morning with all his men, in order to " give battle to the *Rája* himself, to revenge the ill treat- " ment he had received, and, if possible, to recover the " princess his wife. A severe engagement took place, " which lasted all day, and in the darkness of the night " the men of *Johór* fled in every direction. The *Rája*

" escaped to *Tringáno*, and *Rája* MU'DA, with his
" family, took shelter in a neighbouring wood.

" Intimation of the place of *Rája* MU'DA's retreat " being conveyed to the prince, he immediately proceed- " ed thither, and completely surrounded him. *Rája* " MU'DA, finding himself in this extremity, and no hope " of escape left, put his family to death, one by one, in " order that they might not fall into the hands of the " enemy. After which he went forth from the interior " of the wood, and endeavoured to rush through the " *Menangcábaws* who surrounded it, but in vain; being " repulsed in every direction, he threw down his arms, " and solicited them to spare his life. This they would " not listen to, and he was in a moment slain.

" The prince, having thus revenged himself on *Rája* " MU'DA, proceeded towards *Tringáno*, hearing that the " *Rája* of *Johór* had fled thither. On the prince's arri- " val at *Tringáno*, he demanded of the *Rája* that the " *Rája* of *Johór* should be given up to him, and the " *Rája* of *Tringáno* complied with his request. On the " *Rája* of *Johór* being delivered up, he was immediately " put to death by the enraged *Menangcábaws*.

" The prince then recovered his wife from the *Rája* of " *Tringáno*, with whom she had been left by her father; " and, having remained a few days at *Tringáno*, he re- " turned with his followers to *Johór*. At *Johór* he re- " mained till such time as the *Práhus* could be repaired " and victualled for the voyage, and then embarked, " with all the *Menangcábaws*, for the kingdom of his " father.

" Several, however, of the *Menangcábaws*, remain- " ed in the country of *Johór*, in consequence of their " being united in marriage to the *Johór* women. The

"country of *Johór*, which was previously well cultivated, "was soon overgrown with wood; but the enclosed vil- "lage, in which the men of *Menangcábaw* resided, still "bears the name of *Campung Menangcábaw*, and many "people are still to be found scattered over the country "who call themselves *Menangcábaws*, as it was for "many years that the prince resided in this country, and "his followers and those connected with him had become "very numerous."

The ancient connexion that subsisted between *Maláca* and *Johór* is particularly noticed in *Maláyu* history, according to which the first *Rája* of *Maláca*, *Sultan* ISKA'NDER SHAH, (afterwards, on his embracing the *Muhammedan* faith, called MUHAMMED SHAH,) is supposed to have been a *Rája* of *Sin'hapura*, the ancient *Malay* state, near the site of *Johór*, who had taken refuge there, on his kingdom being invaded and destroyed by an armament from the island of *Java*. The subsequent flight of the *Maláca Rája* to the southern port of the peninsula, on the establishment of the *Portuguese*, is related in several *Malay* MSS. in my possession, from one of which the following narrative is a translation. If *Maláca* be considered as the principal state on the peninsula, the fate of its native government cannot be uninteresting, though the record must be of modern date. *Sultan* MUHAMMED SHAH, the present *Rája* of *Linga* and *Rio*, whither the seat of government has long been transferred from *Johór*, still traces his descent from the ancient *Rájas* of *Maláca*.

Translation of a Maláyu Manuscript, entitled, "A History of former Times, containing an Account of the first Arrival of the Portuguese at Maláca."

"It is related that ten *Portuguese* vessels from *Manila* arrived at *Maláca*, for the purpose of trade, during

"the reign of *Sultan* AH'MED SHAH, at a time when "that country possessed an extensive commerce, and "every thing in abundance, when the affairs of govern- "ment were well administered, and the officers properly "appointed.

"At the time that these ships arrived, the fort was "composed of *Nibungs*. Alas! with how many other "captains did the commander of the *Portuguese* enter "the fort! and with what presents of gold, of dollars, of "cloths, of *Manila* chains, did they present themselves "before the *Rája!* and how pleased to excess was *Sul-* "*tan* AH'MED SHAH with the *Portuguese!* Whatever "the commander required, *Sultan* AH'MED SHAH was "ready to grant; but how many *Bendaharas* and "*Tamungungs* with due obedience urged the *Rája* to "be on his guard against the *Portuguese;* 'for', said they, "'even the most experienced among us does not recollect "a misfortune so great as the arrival of the *Portuguese!*' "To this the *Rája* would reply, 'Alas! my revered "*Bendahara*, and you respected *Tamungungs*, you "know nothing when you state that these white men will "do what is wrong in our country.'

"The *Bendahara* and the *Tamungungs* still remained "of the same opinion respecting the *Portuguese*, and "were not well inclined towards them; but finding that "their representations were not attended to, nor well re- "ceived by the *Rája*, they ceased to make them. To "how many of the rich and great men did the com- "mander of the *Portuguese* present *Manila* chains! and "how pleased was every one with the *Portuguese!* "The *Bendahara* and the *Tamungungs* were alone "dissatisfied.

"For forty days the *Portuguese* ships traded at "*Malácca;* but still the *Portuguese* commanders re-

" mained on shore, presenting dollars by the chest, and
" gold; and how many beautiful cloths did they present
" to the illustrious *Sultan* AH'MED SHAH, so that the
" *Sultan* was most happy!

" After this *Sultan* AH'MED SHAH said to the com-
" manders of the *Portuguese*, 'What more do you
" require from us, that you tender us such rich presents?'
" To this the commander replied, 'We only request one
" thing of our friend, should he be still well inclined
" towards the white men.' Whereupon *Sultan* AH'MED
" SHAH said, 'State what it is, that I may hear it; and,
" if it is in my power, I will comply with the request of
" my friend.' The *Portuguese* answered, 'We wish to
" request a small piece of ground, to the extent of what
" the skin of a beast may cover.' Then, said the *Rája*,
" let not my friends be unhappy; let them take whatever
" spot of ground they like best, to the extent of what they
" request.'

" The captains were highly rejoiced at this, and the
" *Portuguese* immediately landed, bringing with them
" spades, bricks, and mortar: the commander then took
" the skin of the beast, and, having rent it into cords,
" measured out therewith four sides, within which the
" *Portuguese* built a storehouse of very considerable
" dimensions, leaving large apertures in the walls for
" guns; and when the people of *Malàca* inquired the
" reason of the apertures being left, the *Portuguese* re-
" turned for answer, 'These are the apertures that the
" white men require for windows.' The people of
" *Malàca* were satisfied and content.

" Alas! how often did the *Bendahara* and the
" *Tamungungs* approach the *Rája* with a request that
" the white men might not be permitted to build a large
" house; but the *Rája* would say, 'My eyes are upon
" them, and they are few in number: if they do any

" wrong, whatever it may be, I shall see it, and will " give orders for their being massacred (literally, I will " order men to *amok*, or, as it is vulgarly termed, run a " *muck* among them). Notwithstanding this the *Bendahara* and the *Tamungungs* remained dissatisfied in " their hearts, for they were wise men.

" After this, the *Portuguese*, during the night, con" veyed cannon into their storehouse, and they landed " small arms, packed in chests, saying the contents were " cloths: and in this manner did the *Portuguese* deceive " and cheat the people of *Maláca!*

" What the *Portuguese* next did, the people of " *Maláca* were ignorant of, but it was long before the " storehouse was completed: and when all their arms " were in order, then it was at midnight, at a time that " the people of *Maláca* were asleep, that the *Portuguese* " began to fire off their guns from the fort of *Maláca!*

" They soon destroyed all the houses of the people " of *Maláca*, and their *Nibung* fort; and it was during " this night, when the *Portuguese* first attacked the peo" ple of *Maláca*, that *Raja* AH'MED SHAH, with his " people, fled in all directions, for no one could remain " to oppose the *Portuguese*.

" Thus did the *Portuguese* take possession of *Maláca*, " whilst *Sultan* AH'MED SHAH fled to *Móar*, and from " thence, in a short time, to *Johór*, and afterwards to " *Bentan*, to establish another country. Such is the ac" count of the *Portuguese* seizing the kingdom of *Maláca* " from the hands of *Sultan* AH'MED SHAH.

" It is related that the *Portuguese* remained in quiet " possession of the country of *Maláca* for three years, " after which they sent letters to their great country, " which is called *Goa*, giving an account that the king-

" dom of *Maláca* was conquered. As soon as this in-
" telligence arrived, the *Rája* of the *Portuguese* was
" exceedingly happy ; and in about two months after he
" answerred the letters, and ordered the *Portuguese* to
" build a fort at *Maláca* of iron stone, and the form of
" the fort to be like that at *Goa*. Such was the occasion
" of the fort of *Maláca* resembling that of *Goa*.

" As soon as the letters arrived at *Maláca* from the
" *Rája* of *Goa*, the *Portuguese* who were in *Maláca*
" ordered such of the people as had remained there to
" bring iron stones for the fort from *Quála Lingi*, *Pulau*
" *Upi*, *Batu Bras*, *Pulau Jawa*, (a small island near
" *Maláca*,) from *Teloh Mas*, from *Pisau Pringi*, from
" *Pulau Burung*, and from the country in the interior
" of *Maláca* ; and the price which the *Portuguese* paid
" for them was at the rate of thirty dollars for one hun-
" dred stones, if large, and twenty dollars for one hun-
" dred stones, if small. For eggs, which they used in
" their mortar, the *Portuguese* paid at the rate of a
" *Wang Baru** (new coin) for each. For lime (*Capor*)
" they paid fifteen dollars for a *Coyen*, and the labourers
" employed in digging away the hill were paid at the
" rate of half a dollar each for one day's work.

" During thirty-six years, three months, and fourteen
" days, the *Portuguese* were employed in the construc-
" tion of the fort, and then it was completed.

" From this time the *Portuguese* remained in quiet
" possession of *Maláca* for about nine years and one
" month, when the country once more began to flourish,
" and the trade became extensive on account of the quan-
" tities of merchandise brought there from all quarters.

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* Twenty-seven Wang Baru are equal to a dollar, the *Madras* fanams.

" Such is the account of the country of *Maláca* under
" the *Portuguese*.

" It is related that after this period a *Dutch* vessel
" arrived at *Maláca* for the purpose of trade; the vessel's
" name was *Afterlenden*, and that of the captain Ibir.
" The captain perceived that *Maláca* was a very fine
" place, and had a good fort; therefore, after the *Dutch*
" vessel had traded for fifteen days, he set sail for *Europe*,
" and arriving after a considerable time at the great coun-
" try, he gave intelligence to the great *Rája* of what he
" had seen, of the beauty of *Maláca*, the extent of its
" commerce, and the excellence of its fort. On this the
" *Rája* of *Europe* said, 'If such is the account of *Maláca*,
" it is proper that I should order it to be attacked.'
" Twenty-five vessels were thereupon ordered by the
" *Rája* of *Europe*, for the purpose of attacking *Maláca*;
" and troops being embarked in each, they first set sail
" for the kingdom of *Bantam*, in the country of *Java*,
" where the *Dutch* were on terms of friendship.

" At *Bantam* they found two *Dutch* ships and a
" ketch; and, after having taken on board buffaloes, and
" provisions for the use of the persons on board, the ves-
" sels then sailed for *Maláca*.

" As soon as the fleet arrived at *Maláca*, the *Dutch*
" sent a letter to the *Portuguese*, telling them to hold
" themselves in readiness, as it was the intention of the
" *Dutch* to commence the attack on the morrow at mid-
" day. To this the *Portuguese* replied, 'Come when
" you please; we are ready.'

" On the next day the *Dutch* commenced the attack,
" and the war continued for about two months, but the
" country of *Maláca* was not carried, and the *Dutch*
" returned to *Bentan*, where they remained quiet for
" some time in the intention of returning to *Europe*; all

" the great men on board the vessels feeling ashamed of
" what had happened.

" The great men in each of the vessels, having afterwards held consultations respecting another attack on *Maláca*, they proceeded against it a second time, but it did not surrender. The *Dutch* now sent a letter to *Johór*, in terms of friendship, to the Sultan, requesting his assistance in the attack of *Maláca*. With this the *Rája* of *Johór* was pleased, and an agreement was entered into between the *Rája* of *Johór* and the *Dutch*, which was sworn to; so that the *Dutch* and *Malays* became as one, as far as concerned the taking of *Maláca*. An agreement was made that the *Dutch* should attack from the sea, and the people of *Johór* from the land. If the country surrendered, the *Dutch* were to return the country and the cannon; and every thing else that might be found within *Maláca* was to be equally divided between the *Dutch* and the people of *Johór*.

" When these terms were agreed upon, the men of *Johór* and the *Dutch* sailed for *Maláca*, and, after attacking it for about fifteen days from the sea, many were slain, as well *Portuguese* as *Malays* and *Dutch*. The *Malays* then held a consultation, and began to think that if they fought against the white men, according to this fashion, *Maláca* would not fall for ten years. It was therefore agreed upon by all the *Malays* that fifty men should enter the fort of *Maláca*, and run a *muck*, or *Meng-amok*.

" The *Malays* then selected a lucky day, and on the twenty-first day of the month, at five o'clock in the morning, the fifty *Malays* entered the fort, and commenced *amok*, and every *Portuguese* was either put to death, or forced to fly into the interior of the country, without order or regularity.

" On this the *Malays* exerted themselves in plunder-
" ing *Maláca*, and the whole was divided between the
" men of *Johór* and the *Dutch*, according to their agree-
" ment.

" The men of *Johór* then returned to the country of
" *Johór*, and the *Dutch* remained in possession of *Ma-*
" *láca*, and from that time to the present the *Dutch* and
" the men of *Johór* have been on the strictest terms of
" friendship.

" This is the account of former times, that was to
" be related."

To return to the subject of the *Undang Undang Maláyu*, it will appear, from what I have previously stated, that the collection of *Malay* laws, as far as regards the *Maláyu* nation separately, is nearly completed; but it appears advisable to adopt a more extensive plan, embracing the original institutions of the various nations among the eastern islands.

Of these, the institutions of *Java*, and of the *Bugis* and *Macasar* states, on the island of *Celebes*, are first in importance.

On the island of *Java* there are several codes of *Undang Undang*, which are celebrated to the eastward; but, as the whole island of *Java* was once under the dominion of the ancient emperor, or *Susuhónang Giri*, a power that is still acknowledged to a certain extent, these may no doubt be traced to one source and authority. The difficulty that has hitherto existed in communicating with *Java*, in consequence of the *Dutch* establishments, has prevented the acquisition of the most important of these institutions. The *Javanese* laws are arranged in

native codes of considerable antiquity, and were collected many years back by the *Dutch* government, for the guidance of their different officers. Of this collection I possess a copy, which will, at any rate, assist in the compilation of a more genuine code, from native authority, whenever circumstances may admit of a communication being opened with the *Javanese Rájas* and chiefs.

From the *Bugis* and *Macasar* nations of *Tana Gúa*, and *Tana Ugi*, or *Celebes*, I have received detached parts of the *Undang Undang*; but the copies that have yet reached me are so incomplete and inaccurate, and bear such evident traces of being but imperfect transcripts from a better digested and more regular code, that they rather excite than satisfy inquiry. I have for some time adopted measures with the view of obtaining, if not the originals, at least more perfect transcripts; in which I have every reason to expect I shall be successful. The two principal codes on this island are those of *Macasar* and *Boni*. The laws as well as the history of the *Bugis* states are of considerable antiquity, perhaps far exceeding those on the island of *Java*. These are preserved in books, the greater part of which are still extant, but only to be found in their purity and correctness towards the inland.

With repect to the *Súlu* islands, I have a short account of their laws and usages, though no regular code: several interesting particulars connected therewith have been collected by Mr. Alex. Dalrymple, and printed in the *Oriental Repertory*.

Of the *Moluccas* I have not yet been able to obtain further information than what has tended to confirm in every respect the detailed and full account given by Valentyn; but, as these islands have lately fallen into the hands of the *English*, whatever may be desiderated

from that quarter may easily be obtained. Though the interior of these islands still possess an original population, their government has long been *Malayan*.

As nothing beyond an imperfect description of a few original tribes has yet been obtained respecting the inland population of *Borneo*, it may be inferred, that as there appears to have been no original nation, of authority or extent adequate to reach the shores, or to be known by any of the states that have been established on the coast, their institutions, if they possess any, cannot be of importance, as they have not had any effect on the general population of the eastern *Archipelago*.

On *Sumatra*, Mr. MARSDEN has so well and diligently trodden the ground, that we cannot perhaps, contrary to his assertion, expect to find written laws and institutions among any of the original nations. The compilation that has been made there by the *English* residents will form a valuable standard for comparison with the laws and customs of the more eastern islands; but, at the same time, a more extensive research into the interior, if unsuccessful in its principal object, cannot fail to be interesting in as far as it may lead to a more intimate acquaintance with the *Battas* and *Menangcábaws*, the former of whom may be considered as the original population of the island; while the establishment of the *Menangcábaws* may be compared to that of the *Moguls*, on the continent of *India*. In the *Ketíka líma*, or five times, of the *Battas*, adopted by the *Malays* (of which I have a copy), the divisions of lucky and unlucky times, for undertaking any affair, are expressed by the terms *Mésewára*, *Bisnu*, *Brehma*, *Sri*, *Cála*, corresponding to the *Hindu* deities, more correctly pronounced MAHESWARA, VISHNU, BRAHMA, SRI, and CALA. The table for calculating these superstitious observances is extremely simple.

To the collection that has already been made of the various laws and usages of the *Malays*, *Sumatrans*, *Javanese*, *Bugis*, *Macasars*, and *Súlus*, may be added the compendium of the *Muhammedan* law of inheritance, printed by the *Dutch* at *Batavia*, in 1760, in 102 articles, *Dutch* and *Maláyu*, of which I possess a copy.

As the collection of the *Undang Undang Maláyu* is so various and extended, the compilation must necessarily be deferred until the best authorities procurable can be referred to, and, if possible, the leading native courts visited. In the mean time I request to present to the *Asiatick* Society a sketch of the maritime code of the *Malays*, as translated from the duplicate copies which I have brought with me to *Bengal*; and which, when collated with the more original and authentic copies, and elucidated by notes, corresponding with the general plan of the undertaking, I propose shall form one of six books of the *Malay* laws.

In tracing back the *Malay* laws to those of the more ancient nations on the island of *Sumatra*, *Java*, and the *Celebes*, and thence, perhaps, on one side, to the continent of *India*, and, on the other, to the larger islands in the South Seas, a wide field will be open for research, as well into their origin, as into that of those extraordinary languages, which, in proportion as they are correctly spoken or written, seem to contain a larger intermixture of *Sanscrit*.

The comparatively modern origin of the *Malays* is a fact so generally admitted and universally confirmed by all their writings and translations, that it is difficult to account for the extraordinary opinion laid down by the author of the "Sketch of an intended Essay on the *Malay* Language," that the *Arabians* and *Persians* have borrowed their present alphabetical characters from the

*Malays**; an opinion that could only hope to attract attention from the confident manner in which it is asserted. The proofs that seem to have occurred to the same author, on the "evident antiquity" of the language, and its being from "the primæval stock of JAVAN, one of the "sons of JAPHETH, the third son of NOAH," and from the roots of which *Persian*, *Sanscrit*, and *Arabic* derivatives and compounds have been formed, might as well be adduced in supporting a similar comparison between the *English* and *Latin*, whence we should be rather surprised to find the former, from the number of ancient words it has adopted, asserted to be the parent of the *Roman* tongue.

It is easy and natural to account for the *Malays* having with their religion adopted the written character of the *Arabs*; and I have no hesitation in asserting that neither *Malay* writings nor inscriptions, in their present characters, can be traced back to an æra of greater antiquity than the invention of the modern *Arabic* alphabet, or beyond the period at which the great intercourse between the *Arabians* and eastern nations took place. Admitting, however, that more early writings did exist, there is no reason why they may not have been preserved on *Sumatra* in the more ancient and original characters of the *Battas*, the *Rejángs*, or the *Lampungs*; on *Java*, and the *Celebes*, in the characters of the *Javanese* and *Bugis* nations; and even on the *Malay* peninsula, in some modification of the *Siamese* character.

For the compound parts of the *Maláyu* language, as

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* "A Rough Sketch of part of an intended Essay towards ascertain-"ing, deducing, elucidating, and correctly establishing, the Rudiments "of the *Juhwee* or *Jahwee* Language, vulgarly called the *Malay* "Language, by J. S., and published at *Prince of Wales Island*, 1807. See pages 1, 2, & 3.

it at present exists, and the sources from which we must trace the origin of the nation and its language, I shall only at present refer to the enlightened Essay on the *Indo-Chinese* nations, in a preceding volume of the *Asiatick Researches*: the enlarged views and determined positions in which will, I am convinced, be the more confirmed and verified in the proportion that they may be investigated *.

The most obvious and natural theory on the origin of the *Malays* is, that they did not exist as a separate and distinct nation until the arrival of the *Arabians* in the Eastern Seas. At the present day they seem to differ from the more original nations from which they sprung, in about the same degree as the *Chuliahs* of *Kiling* differ from the *Tamul* and *Telinga* nations, on the *Coromandel* coast, or the *Mapillas* of *Malabar* differ from the *Nairs*, both which people appear, in like manner with the *Malays*, to have been gradually formed as nations, and separated from their original stock by the admixture of *Arabian* blood, and the introduction of the *Arabic* language and *Moslem* religion.

The word *Jahwí*, so much insisted on by the author of the "Rough Sketch," is the *Malay* term for any thing mixed or crossed, as, when the language of one country is written in the character of another, it is termed *B'hása Jahwí*, or mixed language; or, when a child is born of a *Kiling* father and *Malay* mother, it is called *Anak Jahwí*, a child of mixed race. Thus the *Maláyu* language, being written in the *Arabic* character, is termed *B'hasa Jahwi*; the *Malays*, as a nation distinct from the fixed population of the eastern islands, not possessing

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* LEYDEN on the Languages and Literature of the *Indo-Chinese* nations. *Asiatick Researches*, Vol. X.

any written character but what they borrow from the *Arabs*.

With respect to the Maritime Institutions which I have now the honour to lay before the *Asiatick* Society, they have been selected on account of their singularity and characteristic peculiarities. The power of life and death vested in the *Nakhodah* may be considered as purely *Malay*, or at any rate to have had its origin in the Eastern Islands; the *Arabs*, from whom alone they could have borrowed a foreign sea-code, not possessing, as far as I have been able to ascertain, any treatise whatever on maritime law, or in any instance admitting the authority of the *Nakhodah*, or captain of a vessel, to inflict capital punishments. In this point of view, the paper, even in its present state, may not be uninteresting; and it may tend in some degree to account for some of the numerous peculiarities of a nation generally believed to act, on most occasions, solely from individual will, and ferocious passion.

Maritime Institutions of the Malays.

CONTENTS.

CHAP. I. Authority of the code—Description of persons on board a *Práhu*—Of the officers and crew—Their authority—Duties and the nature of their engagements—Of the *Kiwis*, or traders.

CHAP. II. Of the divisions of a *Práhu*—Regulations for the safety of the *Práhu* while at sea—Of fire—Of throwing cargo overboard—Of *Práhus* running foul of each other—Of putting into ports, and the mode of trading—Of detentions—Of persons quitting a *Práhu*.

CHAP. III. Of persons who may be in distress, or who have been wrecked at sea—Of *Troves*—Of carrying off slaves from another country.

CHAP. IV. Of crimes and punishments on board a *Práhu*—Of disrespectful and contumacious conduct towards the *Nakhodah*—Of adultery and criminal connexion with women on board a *Práhu*—Of quarrels and dissensions—Of theft.

The Maritime Institutions of the Malays, translated from the Maláyu Language.

IN the following sketch, which defines the laws and usages of the *Malays* at sea, the *Maláca* code has been selected for the text, as well on account of the admitted superiority of that once-flourishing kingdom, among the *Malay* states in general, as from the circumstances of this code having, with but slight modifications, been adopted by several of the ancient and powerful states on the

island of *Celebes*, and still continuing in force among many of the *Bugis* and *Macasar* traders from that island. The *Bugis* and *Macasar* states, which are nations radically distinct from the *Malays*, possess a Maritime Code of still greater antiquity, but in latter times they appear to have in many instances adopted the sea-laws of *Maláca*, nearly in the same manner as the *Romans* adopted the celebrated *Rhodian* code.

The *Maláca* code appears to have been compiled during the reign of *Sultan* MUHAMMED SHAH, the first sovereign of *Maláca*, recorded in the *Maláyu* annals to have embraced the *Muhammedan* faith. This circumstance is understood to have taken place about the year of the *Christian* æra 1276. The origin of the *Malay* code may therefore be considered as nearly coeval with the first establishment of *Islamism* among the *Malays*. The authority of the code is thus stated in the preamble:

" These are the Laws to be enforced in Ships, *Junks*, " and *Práhus*.

" First of all, PATI HARUN and PATI 'ELIAS assembled *Nakhodah* JENAL, and *Nakhodah* DE'WA, and *Nakhodah* IS-HAK, for the purpose of consulting and advising relative to the usages at sea, and of compiling in conformity thereto a code of *Undang Undang*, or Institutions.

" After they had consulted together and collected the laws, they presented them to DATU BENDAHARA SRI MAHARAJA, in the kingdom of *Maláca*, who laid them at the feet of the illustrious MUHAMMED SHAH. Whereupon that prince said, 'I grant the request of the *Bendahara*, and establish these laws and institutions for your government and that of your posterity. When you administer these laws at sea, they shall not be afterwards interfered with on shore. Henceforth let the laws of the

sea be carried into effect at sea, in like manner as those of the land are carried into effect on land, and let them not interfere with each other, for you (addressing himself to the *Nakhodahs*) are as *Rájas* at sea, and I confer authority on you accordingly.

" The several *Nakhodahs* who had framed the code were then honoured with titles; *Nakhodah* JENAL received the title of *Sang Yahi de Rája**, *Nakhodah* DEWA, that of *Sang Utama de Rája*, and *Nakhodah* IS-HAK, that of *Sang Setia de Rája*†.

" In such manner were the laws established and made known, during the times when the kingdom of *Maláca* was tranquil and prosperous, during the reign of *Sultan* MUHAMMED SHAH, and when SRI NARA DE RA'JA was *Bendahara*, and governed that country,

" Therefore, as the laws of the sea are established, as well as the laws of the land, let them be observed, in order that whatever is undertaken may be properly regulated. Let these laws be followed towards all countries; in as much as the laws of the sea, which relate to the sea only, and the laws of the land, which relate to the land only, are defined: because those of the sea cannot interfere with those established on shore.

" According to these institutions, let the law be administered at sea, that no disputes and quarrels may take place. Let them be known and descend to posterity, that men may not act according to their own will and inclination, but that order and regularity may prevail on board vessels, as well during prosperity as adversity. Let not what is established be done away, nor these laws be resisted or disobeyed !

* & † According to other copies, these titles are *Sang Boya de Rája* and *Setia Dupati*.

"If these laws are attended to, no one can question the authority of the *Nakhodah*, for as the *Rája* is on shore, so is the *Nakhodah* at sea. This authority has been conferred, by the *Sultans* of the land, upon all *Nakhodahs*, in order that they may administer the laws on board their respective vessels. Whoever does not admit this authority offends against the law."

It may be necessary to premise, that although the number and description of persons must materially depend on the size of the vessel and the nature and extent of the voyage, yet the following classes and denominations will be found to occur in almost every *Práhu*, a term under which the *Malays* include every description of vessel.

The *Nakhodah*, or captain, who employs a *Jeru-tulis*, or writer, who corresponds in some degree to a purser.

The *Kiwi* or *Kiwi Kiwi*, the principal of which is termed the *Mala Kiwi*—Supercargoes or persons who have an adventure in the voyage, and to whom part of the cargo belongs.

The *Orang Tumpang* or *Menumpang*—Passengers from one port to another.

Officers and Crew.

Malim—The master. There are generally two, denominated the *Malim Besar* and *Malim Kichil*, the superior and inferior, the latter of whom is also termed *Malim Ang*, whose duty is principally to manage the sails according to the wind; the chief *Malim* attending to the course of the *Práhu*.

Jeru-mudi—Persons who steer the ***Práhu.***

Jeru-batu—Persons who attend the anchor and fore part of the *Práhu.*

Tukang—Literally workmen, petty officers, having specific duties according to their denominations, as *Tukang Peták*, the officer of the hold; *Tukang Agung*, the officer of the main-mast, or chief petty officer; *Tukang Kiri*, the officer of the larboard or left side; *Tukang Kánen*, the officer of the right or starboard side, &c.

Awák Práhu or *Anák Práhu*—The crew or common men, who may consist either of freemen, debtors, or slaves.

Of the Rank and Authority of the Nakhodah and Officers.

"Let every man obey the *Nakhodah*, agreeably to the authority conferred upon him by the *Sultans* of the land from time immemorial, for he is the *Rája* while at sea, and, although he may be young, he shall be as an *Orang tuah*, or have the authority of age, and administer the law accordingly.

"First.—It is the law that in all *Práhus* of every description the *Nakhodah* shall be as the *Rája*.

"That the *Jeru-mudi* or steersman shall be as the *Bendahara*, or prime minister, and the *Jeru batus* as *Tamungungs* or chief peace officers; and it shall be the duty of these to superintend every one, and to regulate right and wrong within the *Práhu*.

"That the *Tukang Kánen*, and the *Tukang Kiri*,

shall possess a respectable influence, and perform duty with the *Tukang Agung*.

"That the *Jeru-batu Kiri*, the *Gung Tang* and *Sinawé*, as well as the *Tukangs*, shall be under the immediate orders of the *Nakhodah*; and all the *Awak Práhu* shall be under the orders of the *Tukangs* belonging to the *Práhu*.

"The *Malim* shall be as a ruler or judge* at sea, as it is his duty to direct the course of the vessel."

In the *Macasar* copy it is stated "that the owners of the *Práhu* shall be as the *Rája*, the *Nakhodah* as the *Bendahára*, the *Tukangs* as the *Tamungungs*, the *Tukang Haluén* (officers of the forecastle) as masters, and the *Tukang Tengah* as *Sida Sidas*;" but as the *Nakhodahs* are generally, and always, in the smaller *Práhus*, owners, the distinction made at *Macasar*, which changes the comparison in the ranks of the different officers, in consequence of the introduction of a superior to the *Nakhodah*, is of no real importance, and does not essentially vary the rank or influence of the officers.

"If any of the crew disobey the orders of the *Tukang-Agung*, that officer shall deliver the offender over to the *Jeru-batu*, in order that he may be punished with seven stripes. But it is the usage that such stripes shall not be inflicted with an uplifted or extended arm, nor without the knowledge of the *Tukang Agung*. If the person who has offended still resists the authority of the *Tukang Agung*, he shall be punished with four stripes more."

According to the *Macasar* copy, the *Awak Práhu* are stated to be under the immediate orders of the *Tukang*

* *Hakim* or *Imam*.

Tengah. If any one resists his authority, he shall, in the manner above described, be punished in the presence of the *Tamungung* (*Jeru-mudi*) with three times seven stripes. And if the offender still resists the authority of the *Tukang*, it shall be lawful for the *Tamungung* to hang him up (suspend him by the arms), and to punish him with three stripes more."

"If any of the crew disobey the *Guntang* and *Sinawé*, the offender shall be punished with three stripes."

Of the Duties of the Officers and Crew, and the Nature of their Engagements.

There is no description of persons who receive wages on board a *Práhu*, with the exception of persons who may act as substitutes for such as may be obliged to quit the *Práhu*, on account of illness or otherwise. Every person on board has some commercial speculation in view, however small, and his engagement is made for the voyage.

The *Nakhodah*, or owner of the *Práhu*, gives to each, according to established custom, what is termed *Tulungén*, which signifies assistance or advances; which advances are of two kinds, consisting either of shares of the cargo, or loans of money.

In short, the whole voyage is to be considered as a commercial adventure of the whole of the persons engaged in it, and bears no slight similarity to the outfit of a *Dutch* whaler.

Of the Malim.

"The law respecting the *Malim* is, that he shall, if he requires it, be allowed one half of a division of the

hold, and receive a further assistance from the *Nakhodah* to the extent of a *Tahil* and a half (twelve dollars), this officer being on the same footing with the *Malim besar*, or chief *Malim*.

It is the duty of the *Malim* to remember the proper course to steer, and to know the seas and the lands, the winds and the waves, the currents, the depths and the shallows, the moon and the stars, the years and the seasons, the bays and the points of land, the islands and coasts, the rocks and shores, the mountains and hills, each and every one of them, and also to know where the *Práhu* may be at any time. With the whole of these should the *Malim* be well acquainted, in order that every thing may go on prosperously, as well at sea as on land, and that the *Malim* may be free from fault.

"While a *Práhu* is at sea, the *Malim Ang* shall have charge of all the cordage and rigging. He shall give orders respecting the same to the *Tukang Agung*, whose duty it is to see that the *Awak Práhu* do what is necessary respecting the same. The *Tukang Kiri* and *Tukang Kánen* shall also assist in superintending the *Awak Práhu*."

According to the *Macasar* copy, any of the *Awák Práhu* who may neglect their duty, or the orders of the *Tukangs*, may be punished at the *Pataren Lawang*, or place where the cable and ropes are kept, with seven stripes.

"If every thing is not at sea as the *Malim* wishes it, and the sails are taken aback, let him, on his return to port, give alms to the poor, as an acknowledgment for his escape.

"If the *Malim* forgets the course he has to steer, and through his ignorance the *Práhu* is wrecked, he shall suffer death, for such is the law.

"If the *Malim* is desirous of quitting the *Práhu* at any port or place, he shall not be permitted to do so."

Of the Jeru-mudi, or Steersman.

"It is the duty of the *Jeru-mudis*, when relieved from their tour of duty at the helm, to superintend and take care of all the arms in the *Práhu*; and in the event of the *Práhu* falling in with pirates, let them combat with a strong hand and courageous heart, for such is their duty."

By the *Macasar* copy, it is established, that if the *Jeru-mudis* or *Jeru batus* are desirous of quitting the *Práhu* at any time, they may be permitted to do so, on paying, the former, the sum of half a *Tahil* or one *Pahar* (four or two dollars), and the latter one *Pahar* or two *Mas* (one dollar), each according to his ability, but not exceeding the sums stated.

Of the Petty Officers and Crew.

"If the *Práhu* is from three to four *Depahs* (fathoms) wide, the *Awak Práhu* shall be allowed assistance, or a participation in the cargo, to the extent of one *Coyen*, and all other persons, not slaves, two *Coyens* *.

"If the *Práhu* is two and a half *Depahs* wide, the

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* The *Malay* measures alluded to are as follow:

4 *Chupalis*,	equal		1 *Gantang* (about a gallon).
16 *Gantangs*,			1 *Nalí*.
10 *Nalí*,	*or* 160	*Gantangs*,	1 *Koncha*.
5 *Koncha*,	*or* 800	*Gantangs*,	1 *Coyen*, which is generally

calculated at something more than a ton, but varies.

Awak Práhu shall be allowed three hundred *Gantangs*, and the others, not slaves, six hundred *Gantangs*."

Independent of the descriptions of persons above alluded to as belonging to the *Práhu*, it may be necessary to advert to slaves and debtors, particularly the latter, respecting whom the law is as follows :

" When any person wishes to bind himself in personal service for a debt, let an agreement be required, at the time, that the debtor shall follow and perform service for his creditor for the term of three years, three months, and three days, ' or, according to the *Macasar* copy, for the term of three years,' in order that, if the party is not willing to conform thereto, he may not become a debtor, or, if willing to do so, that he may follow and serve his creditor accordingly.

" If, at any time before the expiration of the above-mentioned period, the debtor wishes to discharge the obligation, he shall be required to pay an advance at the rate of one in ten on the amount of his debt, in addition to the principal ; unless he does this, he need not be permitted to quit the *Práhu*. ' According to the *Macasar* copy,' if the debtors of the *Nakhodah* wish to quit the *Práhu* at any place by discharging their obligation, they shall, on paying the advance of one in ten on the amount of their debt, be discharged, and not considered liable to the duty of the country ; but if they have property in the *Práhu* beyond the amount of their debt, a further demand is authorized, according to their ability, to the extent of a *Pahar* (two dollars) each."

Of the Kiwis or Traders.

" This is the law relating to the *Kiwis*; they shall pay for the tonnage they require, unless they have assisted the *Nakhodah*, in his trading concerns, to the extent of three or four *Tahils* (twenty-four or thirty-two dollars), in which case the *Nakhodah* shall give them two or three *Coyens* of tonnage, or one division of the hold, it being considered that the profit on the three or four *Tahils* is an adequate compensation.

" The *Kiwis* may obtain seven or eight divisions of the hold, but they shall not pay for four divisions, as long as they are under agreement to pay a duty on their return to port (on the goods they lade), at the rate of four out of every thirteen.

" The *Mala Kiwi* shall be entitled to half of the division of the hold in which the rice or provisions are stowed (*Petah Gandung*), because he is the *Pung'hulu*, or head man of all the *Kiwis*.

" With respect to the duties of the country on the eight divisions of the hold, and also on the sails, it is the law, that the *Kiwis* shall present eight pieces of cloth and a bundle of rattans. The *Kiwis* who present these shall be freed from paying all other duties of the country, because this is adequate.

" It is the usage, that in all affairs that may arise, good or bad, the *Nakhodah* shall advise with and consult the *Mala Kiwi* and the *Kiwis*."

CHAPTER II.

" IT is the established law of the *Undang Undang (istéadat hukum Undang Undang)* that all *Nakhodahs*, and *Malims*, and *Tukangs*, and *Muda Mudas*, and *Awak Práhu*, each and every one shall conform to what is the usage."

The Divisions of a Práhu.

These are the laws respecting the *Balai Lentang*. No person shall go there, except at a time when there is business of importance; and then this is the place on which to assemble for the purpose of advising and consulting. If any of the crew go upon the *Balai Bujur*, and remain there, they shall be punished with five stripes.

The *Balai Bujur* is expressly appropriated for the recreation of the *Muda Mudas*; if any of the crew go there, they shall be punished with three stripes.

No person is allowed to remain in the *Putaren Lawang*, or place where the cable and ropes are kept, except the *Nakhodah*, the *Muda Mudas*, and the *Tukang Agung*; if any of the crew go there, they shall be punished with six stripes.

The *Allang Muka* (the place before the *Nakhodah's* cabin) is appropriated for the *Tukang Teng'ha, Tukang Kanen*, and *Tukang Kiri*: if any of the crew go there, they shall be punished with three stripes.

Regulations for the Safety of the Práhu.

"When a *Práhu* proceeds to sea, every person on board shall be under charge of the *Nakhodah.*

"At the time a *Práhu* is about to sail on her voyage, the *Malim* shall inform the *Tukangs* thereof, who shall direct the persons who have the watch (*Orang berkĕpong*) to take care that the rigging and sails are in order, and to prevent accident by fire, as fire is a dreadful calamity at sea.

"As it is the duty of the *Muda Mudas* to superintend the men on watch, let them be careful that they perform their duty. For if a vessel drifts, or runs on shore, on any coast or point of land, in consequence of the *Muda Mudas* neglecting to superintend the people on watch, it is the law, that the *Muda Mudas*, in such case, shall be punished, and fined according to their ability. With respect to the people on watch, they shall be punished with twenty stripes each.

"If the *Práhu* drifts from her anchorage, and approaches near shore, and the persons on watch are not aware of it, they shall be punished with eight stripes each.

"If the persons on watch allow *Práhus* to pass without hailing them," or, according to the *Macasar* copy, "allow the people in the other *Práhu* to hail first, they shall be punished with seven stripes each." By that of *Macasar:* "The *Orang Muda Mudas* shall also, in such case, be liable to a similar punishment as is directed in the event of slaves absconding from a *Práhu*, which "in the *Maláca* copy," is as follows:

"It is the duty of the persons on watch to super-

intend and watch over all the slaves in the *Práhu*, in order to prevent their absconding. In this duty, as well as in all others, they shall be superintended by the *Muda Mudas*. If, therefore, a slave at any time absconds from a *Práhu*, it shall be the duty of the *Muda Mudas* to find out the person who is to blame, and the person who is so found out shall be punished with sixty stripes." The *Macasar* copy states, " He shall be answerable for, and make good, his value."

" It is the duty of the persons on watch to see that the vessel is properly baled out; if, therefore, too much water is at any time allowed to remain, the persons who are on the watch at the time shall be punished with fifteen stripes each.

" If the persons on watch do not keep a good look-out, and any thing is stolen from the *Práhu*, they shall be punished with two stripes from every person in the *Práhu*.

" It is the usage that persons on watch shall each be allowed the conveniencies for smoking opium, in order that they may not fall asleep during the time that it is necessary for them to keep watch.

" When the term of the watch shall expire, the persons who are to be relieved shall deliver over charge to the persons appointed to succeed them, and give notice thereof to every one, and to the *Muda Mudas*."

" It is the duty of those who dress victuals (*Orang bertupi*) to guard against accident by fire, while a *Práhu* is at sea. After victuals are dressed, the fire shall be carefully extinguished; and if any person neglect to do so, and the cooking-place take fire, the law is, that, after all the people in the *Práhu* shall have put out the fire, the person through whose neglect it was occasioned shall be

punished with two stripes from each person in the *Práhu*, and his master shall be warned to be more careful in future, in order that the servant may not be guilty of such neglect again; for, of all things, fire is to be dreaded at sea.

"If the person who is the cause of the fire is a slave, the master shall be fined four *Paku petis Jawa*. If the master refuses to pay the fine, the slave shall be punished with four stripes," according to the *Malacca*, and "forty stripes," according to the *Macasar* copy. "And such punishment shall be inflicted at the *Temba Ruang*, or place from which the *Práhu* is baled out."

The Laws respecting throwing Cargo overboard.

"When there is a violent storm, and it may be necessary to throw overboard a part of the cargo, for the safety of the *Práhu*, a general consultation shall be held with respect to the property in the *Práhu*, and those who have much and those who have little must agree to throw overboard in proportion.

"If the *Nakhodah* omits to assemble all those who are interested, and the cargo is thrown overboard indiscriminately, the fault shall be on the *Nakhodah* of the *Práhu*, for such is not the custom."

Of Práhus running foul of each other.

"If a *Práhu* runs foul of a guard or armed vessel (in which case the crew are liable to forfeit their lives), the offence may be compounded by each person on board the *Práhu* paying such sum, as a ransom for life, as may be agreed upon, each paying alike, whether slaves or not

slaves, rich or poor, youths, men or women; and no one more than another.

"If during a heavy sea, or high winds, a *Práhu* strikes upon a rock, or on a shore or shoal, or runs foul of another *Práhu*, by which one is lost, the law is, that the loss shall not be considered as accident, but as a fault, because, when there is a heavy sea, the *Práhu* ought to be kept out of the way from such occurrences.

"The law therefore states, that, whether the parties are rich or poor, the loss occasioned by the damage or wreck of the *Práhu* shall be divided in three proportions, one of which shall be borne by the person to whom the damaged or lost *Práhu* belonged, and the remaining two-thirds by the persons who were the occasion of it."

The *Macasar* copy differs in this respect, being as follows:

"During the time that there are one or more *Práhus* in company, and there happens to arise a storm, and the *Práhus* run foul, so that one is damaged, the fault shall be upon the persons in the *Práhu* that runs foul of the other, and the law is (*Papa Gurma*) according to what the loss or damage may be; the amount shall be divided into three parts, and one part only shall be made good by the persons in fault, the other two parts being lost."

Of putting into Ports, and the Mode of Trading.

"When the *Nakhodah* may be desirous of touching at any bay, coast, or island, he shall hold a general consultation, and, if it is approved of and agreed upon, it is proper that the *Práhu* shall go where he wishes. But if the *Práhu* puts into any port or place without the

Nakhodah having previously held a consultation, the *Nakhodah* is guilty of a fault.

"In like manner, if the *Nakhodah* is desirous of sailing to any other place, or of crossing from one shore to another, he shall first hold a consultation; and then, if it is agreed that it shall be so, the ropes shall be put in order; and, when the rigging and sails are ready, a further consultation shall be held with the *Jeru-mudi* and *Jeru-batu*, and the *Tukang Agung*, in order that the *Práhu* may proceed accordingly.

"When a *Práhu* arrives at any port, the *Nakhodah* shall be first allowed to trade for four days, after which the *Kiwis* shall trade for two days, and then it shall be allowed to all on board the *Práhu* to trade.

"On the *Nakhodah's* going on shore he shall be accompanied by the *Muda Mudas*, who shall afterwards return to their duty on board the *Práhu*.

"After the regulated period for trading shall have expired, and the *Nakhodah* wishes to make a purchase, no person belonging to the *Práhu* shall offer a higher price; and if there are any persons who offer to purchase the goods of the *Mala Kiwi*, or others, it is the law that the *Nakhodah* should first be made acquainted with the price.

"If any person on board a *Práhu* shall purchase a slave, or any merchandise, without informing the *Nakhodah* thereof, it is lawful for the *Nakhodah* to take them to himself, on paying the original cost.

"If any person on board a *Práhu* purchases a female slave, without the knowledge of the *Nakhodah*, it is the law, that the *Nakhodah* may take her to himself without reimbursement to the purchaser. Such is also the

law with respect to runaway slaves, who may be so purchased."

According to the *Macasar* copy, the following is the amount of duty to be paid by *Práhus* at different ports.

" When a *Práhu* arrives at *Java*, the amount of tribute or duty on account of each division of the hold is five hundred *Petis*, two sails, and one bundle of rattans.

" At *Bima*, six hundred *Petis*, two sails, and one bundle of rattans.

" At *Timor*, seven hundred *Petis*, two sails, and one bundle of rattans.

" At *Mengcasar*, or *Macasar*, two *Gantangs* of gunpowder, three sails, and two bundles of rattans.

" At *Tanjung Pura*, six hundred *Petis*, two sails, and one bundle of rattans.

" When slaves are purchased at *Java*, the duty shall be calculated on twelve men, for each division of the hold, and when at *Mengcasar* at ten men for each division of the hold.

" And whatever *Práhu* goes to any country for the purpose of trading, the duties of the country are calculated upon each *Práhu*, having eight divisions of the hold."

Of Detention.

" The law is, that when the season is nearly over (*Musim Kassis*), and the *Nakhodah* of the *Práhu* omits to sail, the *Kiwis* shall wait, on his account, for seven

days; after which, if the *Nakhodah* does not proceed, and the season is over, the price paid for the divisions of the hold shall be returned to the *Kiwis*.

"If the *Kiwis* are the cause of the delay, and the season is nearly over, the *Nakhodah* shall detain the *Práhu* seven days on their account, after which he is authorized to sail without them (if they are not ready), and no more shall be paid or done relating thereto.

"If the season is not far encroached upon, and the *Nakhodah* shall be desirous of sailing with despatch, let him give notice thereof to the *Kiwis*, and enter into an agreement with them to sail in seven or fifteen days, and if the *Kiwis* are not then ready, the *Nakhodah* is authorized to leave them behind, and to sail."

Of Persons quitting a Práhu.

"If a *Kiwi* quits the *Práhu* (of his own accord) at any place during the voyage, he shall forfeit the price paid for his division of the hold, and have no further claim on the *Nakhodah*.

"If it is on account of any disagreement or quarrel that he is desirous of quitting the *Práhu* (and in order to prevent mischief), one half of the sum paid for his division of the hold shall be returned.

"But if a *Kiwi* is very quarrelsome, and creates much trouble and dissension, it is proper for the *Nakhodah* to send him on shore as soon as possible, and to return him the price he has paid for his division of the hold.

"The law with respect to passengers (*Orang Menumpang*) is, that if they quit the *Práhu* at any

time before they arrive at their destination, even if the voyage is only half completed, it shall be the same as if they had reached their destined port, and no part of what has been paid shall be returned.

" If one of the crew is sick, it is proper to wait for him five or seven days; and if he is not then recovered, and the rest of the crew shall say, " Why are we to bale out the vessel without his assistance?" they shall be authorized to inquire for a man for hire, but it must not be one of the crew that is so hired for wages, because no person can perform the duty of two. If the *Nakhodah* cannot find a substitute, the wages shall remain in his hands, and he shall divide the sick man's share of the cargo, and property in the vessel, among the rest of the crew."

CHAPTER III.

Of Persons who may be in distress, or who have been wrecked at Sea (Orang Cáram).

" THESE are the laws relating to persons who may be in distress, or suffer from hunger, in consequence of a scarcity of rice and paddy in their country.

" If at a time when, in consequence of its having pleased the Almighty to visit the *Rájas* and nobles with dissensions, or owing to a state of war, there shall be great distress in any country from the want of food, the poor and wretched shall say to the rich, "Take us as your slaves, but give us to eat;" and if afterwards the persons who have relieved them shall be desirous of selling them, when the country has recovered from its distress, it is the law

that they shall give notice thereof to the *Orang Besar*, or principal people, and the magistrate shall direct that the parties be not sold, because they were distressed at the time of the agreement. The magistrate shall, however, order that the person who provided the food shall have a claim on the person who received it, to the extent of one half of the amount of his value.

"If a slave is not provided with food by his master, the magistrate shall direct him to perform service for the person who relieved him for four seasons; after which he shall be returned to his master.

"If such slave dies, while performing service for the person who relieved him, and the circumstance is made known to the proper officers, he shall not be answerable for his value; but if the slave dies, and the person for whom he performs service does not report it, he shall be answerable to the proprietor of the slave for half the amount of his value, for such is the loss sustained when a slave dies."

"In conformity to the above are the laws respecting persons in distress at sea, or who have been wrecked; for if the persons who have been wrecked say, "Take us and sell us, rather than allow us to perish here," and the *Nakhodah* takes them accordingly, he shall only have a claim to their services until the *Práhu* reaches the port; when, if he is desirous of selling them, it shall be his duty to report the same to the *Shahbender*, in order that the magistrate may direct that the *Nakhodah* be entitled to half the amount of their value. What the persons who were wrecked may have said shall not be attended to, because they were in distress.

"If persons who have suffered from being wrecked are met with at the time they are in the water, swimming, without a chance of their reaching the land in safety, and at their request are taken up by the *Nakhodah* of any

Práhu, the *Nakhodah* shall be entitled to demand, on his arrival at port, the sum of one *Pahar* (two dollars), if the party is not a slave; and, if a slave, the half of the amount of his value, but no more.

"If shipwrecked persons are met under the lee of an island, where they have gone on account of high winds, and they shall be in distress, the demand on account of each, if not a slave, shall be five *Mas* (two dollars and a half), and, if a slave, seven *Mas* (three dollars and a half) each."

Another copy of the *Maláca* code states that the *Nakhodah* shall be entitled to demand as follows, on account of the *Gantung Layer*, or hoisting of the sails.

"For all persons who may have been wrecked, met at sea, and taken up, the *Nakhodah* shall be entitled to demand, on account of the *Gantung Layer*, at the rate of a *Tahil* (four dollars) each; and if such persons require to be supplied with victuals, he shall be entitled to make a farther demand at the rate of a *Pahar* (two dollars) each.

"The *Nakhodah* is also authorized to make a similar demand for all persons who may have been passengers in vessels that have been wrecked, if they have not reached their destined port, according to their agreement; and if they shall land previously, the law is that the demand shall (also) be at the rate of half a *Tahil* for each. If otherwise (or they shall have arrived at their destination) a *Pahar* (two dollars) each, which is in full of all that can be demanded."

Of Fishermen.

"It is the law with respect to fishermen (*Orang Penga'il*), men who fish with lines and hooks, that if they

have lost their *Práhu*, and are taken up by fishermen of their own class, the demand shall be at the rate of one *Pahar* (two dollars) for each. And if they still retain their *Práhu*, but have lost their sails and paddles, in such case the demand to be made by those who take them up shall be two *Mas* (one dollar) each. For such is the law respecting fishermen of this description.

" The laws respecting *(Orang Meniuwás)*, fishermen who fish in fishing weers, are the same when they are wrecked and in distress as the laws of the sea, but they shall be administered by the *Shahbender* of the port."

Of Troves.

" These are the laws respecting any thing that may be found, whatever it may be, whether gold, silver, run-away slaves, or otherwise.

" Whatever is found on the sea, whoever may discover it, is the property of the *Nakhodah* of the *Práhu*, who may give what he thinks proper to the persons who found it.

" Whatever may be found by persons sent on shore to procure wood or water in like manner becomes the property of the *Nakhodah*, because such persons act under his authority, and are performing the duty of the *Práhu*."

According to the *Macasar* copy, " the trove is to be divided into four parts, one of which (only) shall belong to the *Nakhodah*, because there may be many of the finders."

" But whatever may be found on shore by persons

belonging to the *Práhu*, at the time when they are not acting under the *Nakhodah's* orders, nor performing the duty of the *Práhu*, even if the parties are *Kiwis*, or *Túrún Menug'en*, the trove shall be divided into three parts, and one third shall appertain to the finder, and the remaining two parts become the property of the *Nakhodah*.

"If a trove is found under such circumstances by the *Nakhodah's* debtors. In that case one half of the trove shall belong to the debtors and the other to the *Nakhodah*." By the *Macasar* copy, this is also the case with respect to what may be found by the *Túrún Menug'en*.

"If a *Kiwi* goes on shore in any bay, coast, or island, not on account of, or performing the business of, the *Nakhodah*, but exclusively for his own concerns, whatever trove he may find, it shall be divided into two parts, and one half shall appertain to the finder, the other to the *Nakhodah*.

"If any of the *Nakhodah's* family find any thing under such circumstances, the trove shall be divided into four parts, one share of which shall belong to the *Nakhodah*, the other three to the finder." The *Macasar* copy states, "that if a *Muda Muda*, related to the *Nakhodah*, meets with persons who have run away, whether it be in a bay or on a coast, or elsewhere, the *Nakhodah* shall alone be entitled to benefit by it.

"If slaves, belonging to the *Nakhodah*, under any circumstances meet with a trove, it shall become the property of the *Nakhodah*, who may give to the finder what he thinks proper.

"Under whatever circumstances slaves who have absconded from their masters may be met and apprehended by the people belonging to a *Práhu*, they shall

become the property of the *Nakhodah;* who is, however, bound to restore them to the original proprietor, wherever he may be met, and wherever the slaves may be brought from, on being paid one half of their value. Whatever valuables such slaves may have in their possession, at the time they are apprehended, shall belong to the *Nakhodah*.

" If a *Práhu* is driven from the land without the fishing weers, the persons who meet with it, and bring it to the shore, shall be entitled to demand half its value as a reward. But there are two cases in which such reward shall not be given.

" First,—When the rope by which the *Práhu* is secured is cut by any person, and the *Práhu* is carried out by the current, the proprietor shall not be obliged to give any reward.

" Secondly,—When a *Práhu* is stolen by any one, and afterwards set adrift, and is carried to a distance by the current, it is not incumbent on the proprietor to pay any reward to the persons who meet with it, and bring it to the shore.

" The *Práhus* of the *Rája*, or of the *Orang besar besar*, and nobles, shall be exempted. No specific reward shall be demanded for them; but the rich men, to whom they belong, shall give to those who find them what they think proper.

" With respect to *Sanpans*, or small boats, it is the law, that

" When a person meets with a *Sanpan* that has been drifted a considerable way, and has goods in it, and the proprietor demands it back, the value shall be divided

into three parts, and the person who found the *Sanpan* shall be entitled to a quarter of one of those parts. (This appears to apply to rivers only.)

" If a person finds a *Sanpan* out at sea, with goods in it, the law is, that, according to what may be in the *Sanpan*, the finder shall be entitled to one-third part, and the owner receive back the remaining two-thirds.

Of stealing Slaves from another Country.

" If the slave of a *Rája* is stolen, it is the law that the *Nakhodah* shall be put to death. If the slave of an *Orang besar besar*, or of a *Bendahara*, is stolen, the *Nakhodah* shall be fined ten *Tahils* one *Pahar* (eighty-two dollars). If the slave of a *Tamen-Ráyet* (common person) is stolen by the *Nakhodah*, he shall not only return the slave, but pay a fine in additon, equal to the value of the slave.

" If the *Nakhodah* carries off the slave of the *Shahbender*, the law directs that his effects shall be seized, or that he be fined ten *Tahils* one *Pahar* (eighty-two dollars), except the *Orang besar besar* think proper to pardon him.

" If a *Nakhodah* carries off children or young people, or neglects to pay the duties, when he afterwards returns to the port, his effects shall be seized, and he shall be fined, because he has no respect and attention for the country. But, in this case, the *Rája* may pardon him, if he think proper."

CHAPTER IV.

Of Crimes and Punishments on board a Práhu.

" There are four cases, in which it is lawful to inflict capital punishment on board a *Práhu*.

" First,—When any person mutinies against the *Nakhodah*.

" Secondly,—When any person conspires and combines with another for the purpose of killing the *Nakhodah*, the law is, that whoever he may be, whether *Kiwi*, or *Tukang*, or *Malim*, he shall suffer death.

" Thirdly,—When a man, contrary to custom, wears his *Creese*, when other persons in the *Práhu* do not, and with the view of effecting some purpose of his own, and of following his own inclination, it shall be lawful, on sufficient evidence being adduced that it is his intention to do mischief with his *Creese*, to put such person to death without delay, in order to prevent harm."

Under this head, the *Macasar* copy adds, " That when a man is very bad indeed, beyond every other person in the *Práhu*, and evinces his intention of carrying his evil disposition into effect, it is lawful to put such person to death, and nothing more shall be said respecting it."

" Fourthly,—In certain cases of adultery."

Of disrespectful and contumacious Behaviour towards the Nakhodah. (Orang Tajil dan Jedda, or, according to the Macasar Copy, " Orang beadat, jica, bonca.")

" Whoever is not respectful and obedient to the *Nakhodah*, whatever may be his rank or station, such person shall be adjudged and punished according to the nature of his offence, by the law of *Tajil dan Jedda*, and in the same manner as if such conduct had been shewn towards nobles and *Rájas* on shore. Or, the *Sanawé* may be directed to abuse or insult him, and, if he retort, he may be subjected to the abuse and insult of every person on board the vessel. If he ask forgiveness, it may be granted; but let him be punished notwithstanding, in order that he may not do the like another time."

Of Adultery and criminal Connexion with a Woman, on board a Práhu.

" If any person on board a *Práhu* has criminal connexion with the woman of the *Nakhodah*, it is the law that he be put to death.

" If the parties are not slaves, and the woman is married, it shall be lawful for the *Nakhodah* to order them both to be put to death by the crew.

" If the parties are not slaves and both unmarried, they shall be punished with one hundred stripes each, and afterwards obliged to marry. This punishment may be compounded on the parties paying a fine of one *Tahil* one *Pahar* (ten dollars); but in either case they must marry, and, if necessary, be forced to do so, after which the woman's fault shall be forgotten.

"If a man who is not a slave has criminal connexion with a female slave who cohabits with her master, he shall pay to the master the value of such slave, provided she has never been pregnant, and has but lately cohabited with her master; but if she has been pregnant, and long cohabited with her master, the man shall be put to death. In either case the woman shall suffer death.

"If a man who is not a slave commits adultery with the wife of any of the crew, it shall be lawful for the husband to put him to death without further reference. The husband may also put the woman to death; if he does not do so, she becomes the slave of the *Nakhodah;* but if the *Nakhodah* does what is proper, he will order her to be put to death: if he does not, remarks may be made. Should the husband require another wife, the *Nakhodah* shall provide him with one, in order that he may be content and ready in the performance of his duty on board the *Práhu.*

"If a male slave has criminal connexion with a female slave, they shall suffer the punishment of beating, which is to be inflicted by the whole crew, under the superintendence of the *Tukang Agung;* for such is the law in this case with respect to slaves.

"If a man holds improper discourse with the female slave of another person, and it is in the presence of many, he shall be liable to pay her value."

Of Quarrels, Disputes, and Dissensions, on board a Práhu.

"If any person quarrels with another on board a *Práhu*, and attempts to wound or strike him, and the

blow, missing its object, falls on any part of the *Práhu* ;" or, according to the *Macasar* copy, " If any one quarrel with another in a *Práhu*, and in the scuffle cuts or injures any part of the shrouds or cable;" he shall be fined in the sum of four *Paker Petis Jawa.*

" If a man quarrels with another in the fore part of the *Práhu*, and draws his *Creese*, and afterwards comes aft, as far as the place where the sails are kept, towards the person he has quarrelled with, it is lawful that he may be put to death. But, if he can be apprehended, he shall be fined instead to the amount of one *Lacsa*, five *Paker Petis Jawa.*

" If a man quarrels with another, and follows him quarrelling to the door of the *Nakhodah's* cabin, though he may not have drawn his *Creese*, it is lawful to put him to death; but, if he can be apprehended, he shall be fined instead to the amount of two *Lacsa Paker Petis Jawa.*

" If a *Kiwi* quarrels with the *Nakhodah*, and approaches towards him in the after part of the *Práhu*, he may be put to death; but, if he asks forgiveness, it may be granted on his paying a fine of four *Paker Petis Jawa*, and providing a buffalo for the entertainment of the *Nakhodah*," or, according to the *Macasar* copy, " five *Paker Petis Jawa*, and a present to the *Nakhodah* of a buffalo and a jar of *Tuak (Toddy)*."

Of Theft.

" If a man who is not a slave commits a theft on board a *Práhu*, whether the thing stolen be gold, silver, or other valuables, he shall be punished according to the law established on the land.

"If a slave is guilty of a theft, he shall, in the first instance, be confronted with his master; and if it appears that the master knew of the theft, and did not inform the *Nakhodah* or *Tukang* thereof, but it reaches the *Nakhodah* through other information, the law is that the slave's hand shall be cut off, and the master fined as if he himself had been the thief, because the law is the same with respect to the thief and the person who receives the articles that have been stolen."

In concluding the above translation it may be necessary to observe, that, by "the laws of ports and harbours," which may be considered as part of the maritime law, it is established that if there is reason to believe the *Nakhodah* does not conform to the institutions herein laid down, his conduct may be investigated on his return to port.

III.

On the early History of Algebra.

By EDWARD STRACHEY, Esq.

IF it were as generally known, as it is certainly true, that there is a fine field for oriental research in the mathematical sciences, and that it is easy of access, the subject would not be so much neglected as it is at present.

Four years ago I printed at *Calcutta* some observations on the mathematical sciences of the *Hindùs.* In that tract I proved, that an extensive and accurate knowledge of the Algebra of the *Hindùs* might be had, by means of translations, extant in the *Persian* language, of certain *Sanscrit* books. As the *Persian* language is understood by most of the Company's civil servants in *Bengal,* I conceived that a consideration of the fact might induce persons who were competent to such studies to direct their attention to them. Of the *Bíja Ganita,* or *Hindù* Algebra of BHA'SCARA ACHA'RYA, I have sent home a full account, which I suppose must have been published by this time. In that account (derived entirely from a *Persian* translation) it is proved, that the *Hindùs* had made a wonderful progress in some parts of Algebra; that, in the indeterminate analysis, they were in possession of a degree of knowledge which was in *Europe* first communicated to the world by BACHET and FERMAT in the seventeenth

century, and by EULER and DE LA GRANGE in the eighteenth. It would be very curious to push these inquiries into the *Hindù* indeterminate analysis as far as possible. They might, perhaps, shew that the *Indians* had a knowledge of continued fractions, and possibly speculations in physics and the higher geometry, that we know nothing of: for the foundation of the indeterminate analysis of the *Hindùs* is directly explicable on the principle of continued fractions. And there are branches of natural philosophy and mathematics, where equations will arise, which can be solved only by the rules of the indeterminate analysis. In the introduction to the *Bíja Ganita*, where the first principles are given, a method is taught of solving problems of the form $Ax^2 + b = \square$. This, simply considered, may be thought only a vain speculation on numbers; but, in the body of the *Bíja Ganita*, the rule is applied to the solution of equations. It is true, that these equations arise from questions purely numeral; yet it appears, nevertheless, that the application of the rule was understood. But, whatever may be thought of this argument, it is, at all events, interesting to ascertain the progress which has been made in the sciences, by different nations, in distant times.

A good comparison of any of the mathematical sciences of the *Greeks*, the *Arabs*, and the *Indians*, would be exceedingly valuable; and every information which will serve to illustrate the subject is of importance to the early history of science.

We know but very little of Algebra in its infancy and first progress. It was introduced into *Europe* from *Arabia* towards the beginning of the thirteenth century; and the work of DIOPHANTUS became known about three hundred years after. From the difference between his Algebra and that of the *European* writers, there was reason to believe that they were not of the same origin.

Some learned persons thought that DIOPHANTUS was the inventor; but the more received opinion was, that his writings bore internal evidence of the contrary; and that Algebra must have been known long before his time.

In 1579, BOMBELLI published a treatise of Algebra, in which he says, that he and a lecturer at *Rome*, whom he names, had translated part of DIOPHANTUS, adding, "that they had found that in the said work the *Indian* "authors are often cited; by which they learned that "this science was known among the *Indians* before the "*Arabians* had it." (HUTTON'S *Dictionary*.)

DR. HUTTON has adopted the opinion, that the *Arabians* had their Algebra from the *Greeks*. In his Dictionary (article Algebra) we find, "the *Arabians* say, "it was invented amongst them, by MAHOMET* BIN-"MU'SA or son of MOSES, who it seems flourished about "the eighth or ninth century." It may be observed, by the way, that no *Arabian* writer has been cited in support of this. It does not appear on what foundation the assertion stands; I imagine it is taken from WALLIS. The learned *Muslemàns* in *India* certainly consider the science as having originated among the *Indians;* and the arithmetic, which in their treatises always precedes Algebra, is undoubtedly *Indian*.

DR. HUTTON goes on: "It is more probable, how-"ever, that MAHOMET was not the inventor, but only "a person well skilled in the art; and it is farther pro-"bable that the *Arabians* drew their knowledge of it "from DIOPHANTUS, or other *Greek* writers; and, ac-"cording to the testimony of ABULPHARAGIUS, the

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* MUH'AMMED-BIN-MU'S'A-UL-KHA'REZMI, according to D'HERBELOT, flourished under the *Khalifa* MAM'UN, and left a set of astronomical tables, which were highly esteemed before NAS'RUDDIN TUSI published his.

" arithmetic of DIOPHANTUS was translated into *Arabic* by MAHOMET-BIN-YAHYA-BAZIANA." This I suppose is taken from POCOCKE's translation *, but the word which he has explained by " interpretatus est" is وفسر, meaning he commented on, rather than he translated. Surely, this is not sufficient to give rise to a probability that the *Arabians* derived their Algebra from the *Greeks*. The Algebra of the *Arabians* bears no resemblance to that of DIOPHANTUS, the only *Greek* writer on the subject who has ever been heard of. Inquiries have been made, in different parts of *India* and *Persia*, for the supposed translation of DIOPHANTUS; but without success. In the five first propositions of the 13th book of EUCLID, and in the 10th and 11th propositions of ARCHIMEDES' book on spiral lines, and in the 9th proposition of the 2d book of his *Isorropics*, WALLIS thought he saw traces of Algebra; and it is to be presumed, that no farther evidence of its existence, among the ancient *Greeks*, is discoverable; for, except the above, I do not know that any authors have been directly quoted, in proof of the argument; although there has been much assertion, in general terms, that the works of certain writers do contain traces of Algebra. If there were any undoubted marks of it, in the writings of the ancients, they could not have escaped the notice of so learned and so indefatigable a scholar as WALLIS. What he says on this subject appears to result from a prejudiced conviction of the antiquity of the science, and not from an unbiassed search for truth. If the analysis of the five first propositions of the 13th book of EUCLID were (as is believed) by THEON, they could not well be adduced in proof of the ancient *Greeks* having a knowledge of Algebra; because THEON is supposed to have been nearly contemporary with DIOPHANTUS. He could not have been long before him, if it is true that his daughter HYPATIA commented on a work of DIO-

* Diophanti librum de Algebra interpretatus est.

PHANTUS. But, be this as it may, the analysis of the propositions in question is not at all Algebraical. It is the common analysis of the ancient geometers, which is quite different from Algebra; the former being geometrical, and the latter arithmetical. WALLIS's reasoning, on the three propositions of ARCHIMEDES, to which he refers, amounts to no more than this:—The demonstrations, as they now stand, are difficult; they might have been done by Algebra with ease; therefore, it is probable they were done by Algebra. We know of no *Greek* writer on Algebra but DIOPHANTUS; neither he, nor any known author, of any age, or of any country, has spoken, directly or indirectly, of any other *Greek* writer on Algebra, in any branch whatever; the *Greek* language has not even a term to designate the science. The instance of DIOPHANTUS's treatise, with some indirect and disputable arguments, drawn, by inference, from works on other subjects than Algebra, is not sufficient. It is unlikely that the ravages of time and the depredations of barbarians should have destroyed all the direct and indisputable proofs. Such causes might account for the deficiency of our information on certain particulars, but will not authorize forced constructions, to argue the existence of a complete science, from its supposed demolition. The general extent of the literature of the *Greeks*, especially in mathematics, is well known; and that they had Algebra, can be established only by clear and positive evidence. For the different arguments which have been used, and the authorities which have been quoted on this question, see on one side WALLIS's Algebra, chap. 1, 2, 75, &c. with the authors he refers to; and, on the other side, the *French Encyclopédie*, Art. *Algèbre*, *Application*, *Diophante* by D'ALEMBERT, and *Analyse* by DE CASTILLON. See also MONTUCLA. Though BHA'SCARA ACHA'RYA, who is comparatively a modern writer, could not have been one of the authors whom DIOPHANTUS is said to have quoted, it is by no means improbable that some *Alexandrian* merchant,

trading to *India*, might have learned a little Algebra from the *Bramins*, and instructed some of his countrymen; or DIOPHANTUS might have learned from *Indians* at *Alexandria*. If there is doubt of the *Diophantine* Algebra being of *Greek* origin, it is worthy of remark that its author had opportunity of communicating with persons from whom he might have drawn materials for his work, and whom there is evidence of his having actually cited. It is objected that BOMBELLI is the only person who has taken notice of DIOPHANTUS' reference to *Indian* authors, and that no such reference is now to be found in his work. But the authority of BOMBELLI, on this point, cannot be overset, till it is ascertained that the manuscript of the *Vatican*, which he particularizes, does not contain the citations. One would think that BOMBELLI's assertion must have had some foundation, that it is not a mere fabrication. Though it does not appear that any *Sanscrit* works on this science, of greater antiquity than the *Bíja Ganita*, have yet been discovered, we are not to conclude, therefore, that there are none; for the author of the *Bíja Ganita* expressly says, his work is extracted from three copious treatises. These books have not been found; we know nothing of their contents, nor their dates. The following was the result of a general comparison of the *Bíja Ganita* with DIOPHANTUS*. "The *Bíja Ganita* will be found to differ "much from DIOPHANTUS' work. It contains a great "deal of knowledge which the *Greeks* had not; such "as the use of an indefinite number of unknown quan-"tities, and the use of arbitrary marks to express them; "a good arithmetic of surds; a perfect theory of inde-"terminate problems of the first degree; a very ex-"tensive and general knowledge of those of the second "degree; a knowledge of quadratic equations, &c. "The arrangement and manner of the two works will "be found as essentially different as their substance.

* From "observations," &c., above referred to.

"The one constitutes a body of science, which the other "does not. The *Bíja Ganita* is well digested and well "connected, and is full of general rules which suppose "great learning: the rules are illustrated by examples, "and the solutions are performed with skill. DIOPHANTUS, though not entirely without method, gives "very few general propositions, and is chiefly remarkable "for the ability with which he makes assumptions in "view to the solution of his questions. The former "teaches Algebra as a science, by treating it systematically; the latter sharpens the wit by solving a variety "of abstruse and complicated problems in an ingenious "manner. The author of the *Bíja Ganita* goes deeper "into his subject, and treats it more methodically, though "not more acutely, than DIOPHANTUS. The former "has every characteristic of an assiduous and learned "compiler; the latter of a man of genius in the infancy "of science."

The *Greek* Algebra may be seen in DIOPHANTUS, who is the only *Greek* writer on the subject who has ever been heard of.

The *Indian* Algebra may be seen in the *Bíja Ganita*, and the *Lílavati* (by the author of the *Bíja Ganita*); and as the *Persian* translations of these works contain a degree of knowledge which did not exist in any of the ordinary sources of science extant in the time of the translators, they may be safely taken as *Indian*, and of ancient origin. To give some idea of the Algebra of the *Arabians*, whereby we may be enabled to judge whether, on the one hand, it could have been derived from DIOPHANTUS, or, on the other, that of the *Hindùs* could have been taken from them, the work entitled *Khulásat-ul-Hisàb* may be taken as a specimen; especially because, as will be more particularly stated in another place, there is a part of this book which marks the limits of algebraical knowledge, in the time of the writer.

We have seen, that the first *European* Algebraists learnt of the *Arabians*, but no account has been given of the nature, the extent, and the origin of *Arabian* Algebra. No distinct abstract or translation of any *Arabic* book on the subject has appeared in print; nor has it been established, beyond controversy, who taught the *Arabians*. The *Khulásat-ul-Hisàb* is of considerable repute in *India*; it is thought to be the best treatise on Algebra, and it is almost the only book on the subject read here. I selected it, because I understood, that, as well as the shortest, it was the best treatise that could be procured. Besides general report, I was guided by the authority of MAULAVI ROSHEN ALÌ, an acknowledged good judge of such matters, who assured me that among the learned *Muslemàns* it was considered as a most complete work; and that he knew of no *Arabian* Algebra beyond what it contained. In the *Suláfat-ul-Âsr*, a book of biography, by NIZ'AM-UL-DÍN-AH'MED, there is this account of BAH'A-UL-DÍN, the author of the *Khulásat-ul-Hisàb*. "He was born at *Bâlbec*, in the month "*D'hi'lhaj*, 953 *Hijrì*, and died at *Isfahàn*, in *Shawàl*, "1031." Mention is made of many writings of BAHA-UL-DÍN, on religion, law, grammar, &c., a treatise on astronomy, and one on the astrolabe. In this list of his works, no notice is taken of his great treatise on Algebra, the *Behr-ul-Hisàb*, which is alluded to in the *Khulásat-ul-Hisàb*. MAULAVI ROSHEN ALÌ tells me the commentators say it is not extant. There is no reason to believe that the *Arabians* ever knew more than appears in BAH'A-UL-DÍN's book, for their learning was at its height long before his time.

From what has been stated it will appear, that from the *Khulásat-ul-Hisàb* an adequate conception may be formed of the nature and extent of the algebraical knowledge of the *Arabians*; and hence I am induced to hope that a short analysis of its contents will not be unacceptable to the Society. I deem it necessary here to state,

that, possessing nothing more than the knowledge of a few words in *Arabic*, I made the translation, from which the following summary is abstracted, from the *vivâ voce* interpretation into *Persian* of MAULAVI ROSHEN ALÌ, who perfectly understood the subject and both languages, and afterwards collated it with a *Persian* translation, which was made about sixty years after BAHÀ-UL-DÍN'S death, and which ROSHEN ALÌ allowed to be perfectly correct.

The work, as stated by the author in his preface, consists of an introduction, ten books, and a conclusion.

The introduction contains definitions of arithmetic, of number, which is its object, and of various classes of numbers. The author distinctly ascribes to the *Indian* sages the invention of the nine figures, to express the numbers from one to nine.

Book 1 comprises the arithmetic of integers. The rules enumerated under this head are *Addition*, *Duplation*, *Subtraction*, *Halving*, *Multiplication*, *Division*, and the *Extraction of the Square Root*. The method of proving the operation by throwing out the nines is described under each of these rules. The author gives the following remarkable definitions of multiplication and division, viz. "Multiplication is finding a number "such that the ratio which one of the factors bears to it "shall be the same as that which unity bears to the "other factor," and "division is finding a number which "has the same ratio to unity as the dividend has to the "divisor."

For the multiplication of even tens, hundreds, &c., into one another, the author delivers the following rule, which is remarkable in this respect, that it exhibits an application of something resembling the indexes of logarithms.

" Take the numbers as if they were units, and mul-
" tiply them together, and write down the product.
" Then add the numbers of the ranks together (the
" place of units being one, that of tens, two, &c.); sub-
" stract one from the sum, and call the remainder the
" number of the rank of the product. For example, in
" multiplying 30 into 40, reckon 12 of the rank of
" hundreds; for the sum of the numbers of their ranks
" is 4, and three is the number of the rank of hundreds:
" multiplying 40 into 500, reckon 20 of the rank of
" thousands, for the sum of the numbers of the ranks
" is 5."

The following contrivances have sufficient singularity to merit particular mention.

I. To multiply numbers between 5 and 10. Call one of the factors tens, and from the result subtract the product of that factor by the difference of the other factor from ten. For example, to multiply 8 into 9. Subtract from 90 the product of 9 by 2, there remains 72. Or add the factors together, and call the excess above 10, tens. Multiply together the two differences of the factors from 10, and add the product to the former number. For example, to multiply 8 by 7, add to 50 the product of 2 into 3.

II. To multiply units into numbers between units and 20; add the two factors together, call the difference of the sum from 10, tens. From this result, subtract the product of the difference of the simple number from 10 and of the compound number from 10. For example, to multiply 8 by 14. Subtract from 120 the product of 2 into 4.

III. To multiply together numbers between 10 and 20; add the units of one factor to the other factor, and call the sum tens; add to this the product of the units

into the units. For example, to multiply 12 into 13, add 6 to 150.

IV. To multiply numbers between 10 and 20 into compound numbers between 20 and 100; multiply the units of the smaller by the tens of the greater, add the product to the greater number, and call the sum tens. Add to it the product of the units in both numbers. For example, to multiply 12 into 26, add 4 to 26 and call 30, tens. Finish the operation, it is 312.

V. To multiply numbers between 20 and 100, where the digits in the place of tens are the same; add the units of one factor to the other, and multiply the sum by the tens; call the product tens, and add to it the product of the units multiplied by the units. For example, to multiply 23 by 25, multiply 28 by 2. Call the product 56 tens, finish the operation; 575 is obtained.

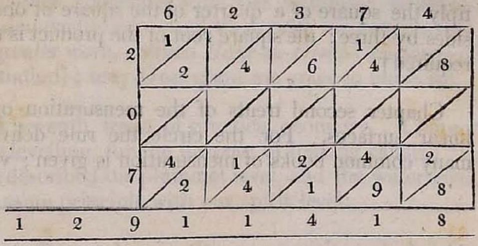
VI. To multiply numbers between 10 and 100, when the digits in the place of tens are different. Multiply the tens of the smaller number into the larger number; add to the result the product of the units of the smaller number into the tens of the greater: call the sum tens; add to this the product of the units into the units. For example, to multiply 23 into 34, add 9 to 68, and 12 to 770.

VII. To multiply two unequal numbers, half the sum of which is simple *(Mufrid)*, take the sum of the two, and multiply half of it into itself. From this product subtract the square of half the difference of the two numbers. For example, to multiply 24 by 36. From 900 subtract the square of half the difference of the numbers, that is 36. There remains 864.

For multiplying numbers consisting each of several places of figures, the method described by this author, under the name of *Shabacah*, or net-work, and illustrated

by the following example, may have suggested the idea of NAPIER's bones.

Multiply 62374 *by* 207.



On the other rules nothing is delivered differing so much from those contained in our common books of arithmetic as to require specific mention.

Book second contains the arithmetic of fractions; and book third the rule of three, or to find an unknown number by four proportionals. Book fourth delivers the rule of position, or to find an unknown number by assuming one once or twice, and comparing the errors. Book fifth gives the method of finding an unknown number, by reversing all the steps of the process described in the question.

The sixth book treats of mensuration. The introduction contains geometrical definitions. Chapter I. treats of the mensuration of rectilinear surfaces. Under this head the two following articles are deserving of notice:—I. To find the point in the base of a triangle where it will be cut by a perpendicular, let fall from the opposite angle. Call the greatest side the base: multiply the sum of the two lesser sides by their difference; divide the product by the base, and subtract the quotient from the

base; one half the remainder will shew the place on the base where the perpendicular falls towards the least side*.

2. To find the area of an equilateral triangle. Multiply the square of a quarter of the square of one of the sides by three: the square root of the product is the area required†.

Chapter second treats of the mensuration of curvilinear surfaces. For the circle the rule delivered in many common books of mensuration is given; viz. mul-

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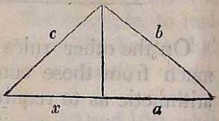
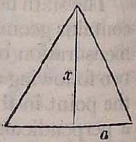
* Let a be the base, or longest side, b the middle, c the smallest, and x the distance of the perpendicular from the least side. Then



$$b^2 = a^2 + c^2 - 2\,ax \text{ (\textit{Eucl.} 13. 2.)}$$
$$2\,ax = a^2 + c^2 - b^2$$
$$x = \frac{a}{2} - \frac{b^2 - c^2}{2\,a}$$
$$\text{But } b^2 - c^2 = \overline{b+c} \times \overline{b-c}$$
$$\text{Therefore } x = \frac{a}{2} - \frac{\overline{b+c} \times \overline{b-c}}{2\,a}$$

See the geometrical demonstration in the elements of plane trigonometry, annexed to SIMSON's *Euclid*, prop. 7.

† Let a side of the triangle be a and the perpendicular, x. The area is $\frac{a\,x}{2}$



$$\text{But } x^2 = a^2 - \frac{a^2}{4} = \frac{3\,a^2}{4}$$
$$x = \sqrt{\frac{3\,a^2}{4}}$$
$$\frac{a\,x}{2} = \frac{a}{2}\sqrt{\frac{3\,a^2}{4}} = \sqrt{\frac{3\,a^4}{16}}$$

iply the square of the diameter by 11, and divide the product by 14*.

Chapter third, on the mensuration of solids, contains nothing of singularity sufficient to merit particular notice. This chapter concludes with the following sentence. "The demonstrations of all these rules are contained in "my greater work, entitled *Bahr-ul-Hisàb* (the ocean of "calculation); may GOD grant me grace to finish it!"

Book seventh treats of practical geometry. Chapter first, on levelling, for the purpose of making canals. In this are described the plummet level, and the water level, on the same principle with our spirit level.

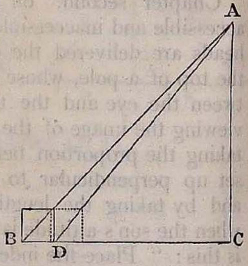
Chapter second, on the mensuration of heights, accessible and inaccessible. Under the former of these heads are delivered the common methods, by bringing the top of a pole, whose height is known, in a line between the eye and the top of the height required; by viewing the image of the top in a horizontal mirror; by taking the proportion between a stick of known length, set up perpendicular to the horizon, and its shadow; and by taking the length of the shadow of the height when the sun's altitude is 45 degrees. The last method is this: "Place the index of the astrolabe at the mark "of 45 degrees, and stand at a place from whence the "height of the object is visible through the sights, and "measure from the place where you stand to the place "where a stone would fall from the top; add your own "height, and the sum is the quantity required."

For the mensuration of inaccessible heights, the following rule is delivered: "Observe the top of the object through the sights, and mark on what shadow-line

* This is founded on the rough proportion of the diameter to the circumference, as 7 : 22. BHA'SCARA, in the *Lilavati*, assigns 1250 : 3927, which is 1 : 3.1416, and differs only 0.000007 from the most accurate computation hitherto made.

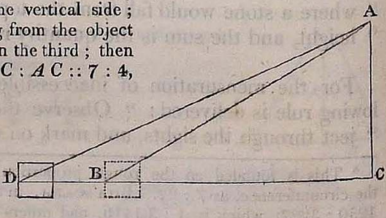
" (division) the lower end of the index falls. Then
" move the index a step forward or backward, and
" advance or recede till you see the top of the object
" again. Measure the distance between your stations,
" and multiply by 7 if the index is moved a *Dhil-*
" *Kadam*, and by 12 if it is moved a *Dhil-As'bâ**,

* This part of the astrolabe consists of two squares put together laterally; the index of the instrument being at the point of the adjacent angles above. One square has seven, and the other twelve divisions: the former called *Dhil-i-Kadam*, the latter *Dhil-i-As'bâ*. The squares are graduated on the outer sides from the top, and at the bottom from the point of the adjacent angles. The divisions on the upright sides are those lines which CHAUCER, in his Treatise on the Astrolabe, calls *Umbra-recta;* those on the horizontal he calls *Umbra-versa.* CHAUCER's astrolabe had only one square, *Dhil-i-As'bâ*, being divided into twelve parts. The *Umbra-recta* is called *Dhil-Mustawì*, and the *versa Dhil-Mâcùs*.



The rule in the text is very inaccurately delivered; for the only case in which it will apply is when at the first station the index coincides with the diagonal of the square; and being afterwards moved one division on the horizontal side, the observer advances towards the object till the top is again seen through the sights. For let AC be the height required, B the first station, D the second. As the angles at A and B are equal, $AC = BC$. But at the second position $AC : DC :: 7 : 6$. Therefore $AC = 7\,BD$.

But suppose, at the first station B, the index falls on the fourth division, *Dhil-Kadam*, on the vertical side; and that, by retiring from the object to D, it is brought on the third; then it is evident that $BC : AC :: 7 : 4$, and $DC : AC :: 7 : 3$. Therefore $DC = \frac{4\,BC}{3} = 4\,BD$. Consequently $7 : 3 :: 4\,BD : AC = \frac{12\,BD}{7}$



" according to the shadow-lines on the astrolabe. This
" is the quantity required.

Chapter third. On measuring the breadth of rivers and the depth of wells. 1st. Stand on the bank of the river, and through the two sights look at the opposite bank, then turn round and look at any thing on the land-side, keeping the astrolabe even. The distance from the observer to the object is the same as the breadth of the river. 2d. Place something over the well which shall serve for its diameter; from the centre of this diameter drop something heavy and shining till it reach the bottom, and make a mark at the centre; then look at the heavy body through the two sights of the astrolabe, so that the line of vision may cut the diameter. Multiply the distance from the mark on the diameter to the place where the line of vision cuts it by your own height, and divide the product by the distance from the place where the line is cut to the place where you stand. The quotient is the depth of the well *.

Book eighth. " On finding unknown quantities by Algebra. In this book are two chapters.

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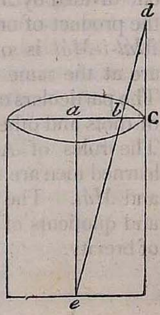
* The impossibility of attaining accuracy in either of these operations is abundantly obvious. The first depends on the principle, that, on a level plain, two places, which, with a given height of the observer's eye, have the same dip below the horizon, must be at equal distances. The second is thus :—Let the body drop from a to e; and let the observer at $c\,d$ observe it in the line $d\,e$, which cuts $a\,c$ in b. Then $bc : cd :: ab : ae = \frac{ab \times cd}{bc}$



"Chapter first. Introductory. Call the unknown quantity *Shai* (thing), its product into itself *Mál* (possession), the product of *Mál* into *Shai*, *Câb* (a die or cube), of *Shai* into *Câb*, *Mal-i-Mál*; of *Shai* into *Mal-i-Mal*, *Mal-Câb*; *Shai* into *Mál-i-Câb*, *Câb-i-Câb*; and so on, without end. For one *Câb* write two *Máls*, and from these two *Máls* one becomes *Câb*; afterwards both *Máls* become *Câb*. Thus the seventh power is *Mál-i-Mál-i-Câb*, and the eighth *Mál-i-Câb-i-Câb*, in the ninth *Câb-i-Câb-Câb*, and so on. All these powers are in proportion, either ascending or descending. Thus the ratio of *Mál-i-Mál* to *Câb* is like the ratio of *Câb* to *Mál*, *Mál* to *Shai*, and *Shai* to one, and one to one divided by *Shai*; and one divided by *Shai* to one divided by *Mál*; and one divided by *Mál* to one divided by *Câb*; and one divided by *Câb* to one divided by *Mál-i-Mál*. To multiply one of these powers by another, if they are both on the same side, (viz. of unity,) add the exponents of their powers together; the product will have the same denomination as this sum. For example, to multiply *Mál-i-Câb* by *Mál-i-Mál-i-Câb*, the first is the 5th power and the 2d the 7th. The result then is *Câb-i-Câb-i-Câb-i-Câb*, or four *Câbs*, which is the 12th power. If the factors are on different sides, the product will be the excess on the side of the greater. The product of one divided by *Mál-i-Mál* into *Mál-i-Câb* is *Shai*; and the product of one divided by *Câb-i-Câb-Câb* into *Câb-i-Mál-i-Mál* is one divided by *Mál*: and if the factors are at the same distance (from one), the product is one. The particulars of the methods of division, and extraction of roots and other rules, I have given in my greater book. The rules of Algebra which have been discovered by learned men are six, and they relate to number, and *Shai*, and *Mál*. The following table will shew the products and quotients of these, which are here given for the sake of brevity.

Dividend.	Multiplier.					Multiplicand.
	$\frac{1}{a^2}$	$\frac{1}{a}$	1	a	a^2	
a^2	1	a	a^2	a^3	a^4	a^2
a	$\frac{1}{a}$	1	a	a^2	a^3	a
1	$\frac{1}{a^2}$	$\frac{1}{a}$	1	a	a^2	1
$\frac{1}{a}$	$\frac{1}{a^3}$	$\frac{1}{a^2}$	$\frac{1}{a}$	1	a	$\frac{1}{a}$
$\frac{1}{a^2}$	$\frac{1}{a^4}$	$\frac{1}{a^3}$	$\frac{1}{a^2}$	$\frac{1}{a}$	1	$\frac{1}{a^2}$
	a^2	a	1	$\frac{1}{a}$	$\frac{1}{a^2}$	
	Divisor.					

" The use of the table is this:—Multiply the co-efficient of one of the two quantities by that of the other; the result is the co-efficient of the product, which is of the denomination contained in the square where the lines from the two factors meet. If on either side there be a subtractive (negative) quantity, call the minuend *plus* or affirmative, and the subtrahend *minus* negative. The products of *plus* into *plus* and *minus* into *minus* are both *plus*, and the products of different kinds are *minus*. Multiply the quantities together, and subtract the negative from the affirmative. For example, the product of 10 and one *Shai* into 10 all but one *Shai*, is 100 all but *Mál*. The product of 5 all but *Shai*, by 7 all but *Shai*, is 35 and one *Mál* all but 12 *Shai*. Another example:—The product of 4 *Mál* and 6 all but 2 *Shai*, into 3 *Shai* all but 5, is 12 *Câb*, and 28 *Shai* all but 26 *Mál* and 30. In division, find a number which multiplied by the divisor will produce the dividend. Divide the co-efficient of the dividend by that of the divisor; the quotient is the

co-efficient of the quantity which is opposite to the dividend and divisor.

" Chapter second. On the six rules of Algebra. To find unknown quantities by Algebra depends on acuteness and sagacity, an attentive consideration of the terms of the question, and a successful application of the invention to such things as may serve to bring out what is required. Call the unknown quantity *Shai,* and proceed with it according to the terms of the question, as has been said, till the operation ends with an equation. Let that side where there are negative quantities be made perfect, and let the negative quantity be added to the other side; this is called restoration (*Jebr*). Let those things which are of the same kind, and equal on both sides, be thrown away; this is opposition (*Mukábalah*). Equality is either of one species to another, which is of three kinds, called (*Mufridát*) simple; or of one species to two species, which is of three kinds, called (*Muktarinát*) compound.

" Case the first. *Mufridát.* Number is equal to things. Divide the number by the co-efficient of the things, and the unknown quantity will be found. For example: a person admitted that he owed ZAID 1000 and one half of what he owed AMER; and that he owed AMER 1000 all but one half of what he owed to ZAID. Call ZAID's debt *Shai.* Then AMER's debt is 1000, all but half of *Shai.* Then ZAID's is 1500 all but a fourth of *Shai.* This is equal to *Shai.* After *Jebr,* 1500 is equal to one *Shai* and a quarter of *Shai.* So for ZAID is 1200 and for AMER 400."

" Case the second. Multiples of *Shai* equal to multiples of *Mál.* Divide the co-efficient of the things by that of the *Mál;* the quotient is the unknown quantity. Example. Some sons plundered their father's inheritance, which consisted of *Dinàrs.* One took 1, another 2,

the third 3, and so on increasing by one. The ruling power took back what they had plundered, and divided it among them in equal shares. Then each received 7. How many sons were there, and how many *Dínàrs?* Suppose the number of sons *Shai*, and take the sum of the extremes; that is to say, 1 and *Shai*. Multiply them by half of *Shai*. This is the number of *Dínàrs*. For the product of the sum of any series of numbers in arithmetical progression is equal to the product of the sum of the two extremes into half the number of terms. Divide the number of the *Dínàrs* by *Shai*, which is the number of the sons; the quotient, according to the terms of the question, will be seven. Multiply 7 by *Shai*, which is the divisor; 7 *Shai* is the product, which is equal to $\frac{1}{2}$ *Mál* and $\frac{1}{2}$ *Shai*. After *Jebr*, and *Múkabalah*, one *Mál* is equal to 13 *Shai*. *Shai* then is 13; and this is the number of the sons. Multiply this by 7. The number of *Dínàrs* will be found 91.

"Questions of this sort may be solved by position. Thus, suppose the number of sons to be 5; the first error is 4 in defect. Then suppose it to be 9, the second error is 2 in defect. The first *Mahfùdh* is 10 and the second is 36; their difference is 26; the difference of the errors is 2. Another method, which is easy and short, is this. Double the quotient (the number 7 in the question), subtract one, and the result is the number of sons.

"Case the third. Number equal to *Mál*. Divide the number by the co-efficient of the *Mál;* the root of the quotient is the unknown quantity, For example. A person admitted that he owed ZAID the greater of two sums of money, the sum of which was 20 and the product 96. Suppose one of them to be 10 and *Shai*, and the other 10 all but *Shai*. The product, which is 100 all but *Mál*, is equal to 96; and after *Jebr* and

Mukábaláh, one *Mál* is equal to 4, and *Shai* equal to 2. One of the sums then is 8 and the other 12, and 12 is the debt of ZAID.

" First Case, of *Muktarinát*. Number equal to *Mál* and *Shai*. Complete the *Mál* to unity if it is deficient, and reduce it to the same if it exceeds, and reduce the numbers and *Shai* in the same ratio, by dividing all by the co-efficient of the *Mál*. Then square one half the co-efficient of the *Shai*, and add this square to the numbers. Subtract from the root of the sum half the co-efficient of the *Shai*, and the unknown will remain. Example. A person admitted that he owed ZAID a sum less then 10, so much that if the square of it was added to its product by $\frac{1}{2}$ what it wants of 10, the sum would be 12. Suppose the number *Shai*, its square is *Mál*; half the remainder from 10 is 5 all but half of *Shai*. The product of *Shai* by this is 5 *Shai* all but $\frac{1}{2}$ of *Mál*. Therefore $\frac{1}{2}$ of *Mál* and 5 *Shai* are equal to 12. One *Mál* and 10 *Shai* are equal to 24. Subtract half the co-efficient of the *Shái* from the root of the sum of the square of $\frac{1}{2}$ the co-efficient of the *Shai* and the numbers. There remains 2, which is the number required.

" Second Case. *Shai* equal to numbers and *Mál*. After completing or rejecting, subtract the numbers from the square of half the co-efficient of the *Shai*, and add the root of the remainder to half the co-efficient of the *Shai*; or subtract the former from the latter; the result is the unknown quantity. Example. What number is that which, being multiplied by half of itself and the product increased by 12, the result is five times the original number? Multiply *Shai* by half itself, then half of *Mál* added to 12 is equal to 5 *Shai*. One *Mál* and 24 is equal to 10 *Shai*. Subtract 24 from the square of 5, there remains one, and the root of one is one. The sum or difference of 1 and 5 is the number required.

" Third Case. *Mál* equal to number and *Shai*. After completion or rejection, add the square of half the co-efficient of the *Shai* to the numbers, and add the root of the sum to half the co-efficient of the *Shai*. This is the unknown quantity. For example:—What number is that, which, being subtracted from its square, and the remainder added to the square, is 10? Subtract *Shai* from *Mál*, and go on with the operation; 2 *Mál* all but *Shai* is equal to 10; and after *Jebr* and *Radd*, *Mál* is equal to 5 and $\frac{1}{2}$ of *Shai*. The square of half the co-efficient of the *Shai* and 5, is 5 and half an eighth, and its root is $2\frac{1}{4}$. To this add $\frac{1}{4}$, the result is $2\frac{1}{2}$, which is the number required.

" Book ninth contains twelve rules regarding the properties of numbers, viz.

" 1st. To find the sum of the products of a number multiplied into itself, and into all numbers below it; add one to the number, and multiply the sum by the square of the number; half the product is the number required.

" 2d. To add the odd numbers in their regular order; add one to the last number, and take the square of half the sum.

" 3d. To add even numbers from two upwards; multiply half the last even number by a number greater by one than that half.

" 4th. To add the squares of the numbers in order; add one to twice the last number, and multiply a third of the sum by the sum of the numbers.

" 5th. To find the sum of the cubes in succession; take the square of the sum of the numbers.

" 6th. To find the product of the roots of two numbers;

multiply one by the other, and the root of the product is the answer.

"7th. To divide the root of one number by that of another; divide one by the other; the root of the quotient is the answer.

"8th. To find a perfect number; that is, a number which is equal to the sum of its aliquot parts (EUCLID, book 7, def. 22). The rule is that delivered by EUCLID, book 9, prop. 36.

"9th. To find a square in a given ratio to its root; divide the first number of the ratio by the second; the square of the quotient is the square required.

"10th. If any number is multiplied and divided by another, the product multiplied by the quotient is the square of the first number.

"11th. The difference of two squares is equal to the product of the sum and difference of the roots.

"12th. If two numbers are divided by each other, and the quotients multiplied together, the result is always one.

"Book tenth contains nine examples, all of which are capable of solution by simple equations, position, or retracing the steps of the operation, and some of them by simple proportion; so that it is needless to specify them.

"The conclusion, which marks the limits of algebraical knowledge in the age of the writer, I shall give entire, in the author's words:—"Conclusion. There are many questions in this science which learned men have to this time in vain attempted to solve; and they have stated some of these questions in their writings, to prove that

this science contains difficulties, to silence those who pretend they find nothing in it above their ability, to warn arithmeticians against undertaking to answer every question that may be proposed, and to excite men of genius to attempt their solution. Of these I have selected seven. 1st. To divide 10 into 2 parts, such, that when each part is added to its square root, and the sums are multiplied together, the product is equal to a supposed number. 2d. What square number is that, which, being increased or diminished by 10, the sum and remainder are both square numbers? 3d. A person said he owed ZAID 10 all but the square root of what he owed AMER, and that he owed AMER 5 all but the square root of what he owed ZAID. 4th. To divide a cube number into two cube numbers. 5th. To divide 10 into two parts, such, that if each is divided by the other, and the two quotients are added together, the sum is equal to one of the parts. 6th. There are three square numbers in continued geometrical proportion, such, that the sum of the three is a square number. 7. There is a square, such, that when it is increased and diminished by its root and 2, the sum and the difference are squares. Know, reader, that in this treatise I have collected in a small space the most beautiful and best rules of this science, more than were ever collected before in one book. Do not underrate the value of this bride; hide her from the view of those who are unworthy of her, and let her go to the house of him only who aspires to wed her."

It is seen above that these questions are distinctly said to be beyond the skill of algebraists. They either involve equations of the higher order, or the indeterminate analysis, or are impossible.

It does not appear that the *Arabians* used algebraic notation or abbreviating symbols; that they had any knowledge of the Diophantine Algebra, or of any but the

easiest and elementary parts of the science. We have seen that BAHA'-UL-DÌN ascribes the invention of the numeral figures in the decimal scale to the *Indians.* As the proof commonly given of the *Indians* being the inventors of these figures is only an extract from the preface of a book of *Arabic* poems, it may be as well to mention that all the *Arabic* and *Persian* books of arithmetic ascribe the invention to the *Indians.* The following is an extract from a *Persian* treatise of arithmetic in my possession :—

" The *Indian* sages, wishing to express numbers con-
" veniently, invented these nine figures ١٢٣٤٥٦٧٨٩٠
" The first figure on the right hand they made stand for
" units, the second for tens, the third for hundreds, the
" fourth for thousands. Thus, after the third rank, the
" next following is units of thousands, the second tens
" of thousands, the third hundreds of thousands, and so
" on. Every figure therefore in the first rank is the
" number of units it expresses ; every figure in the se-
" cond the number of tens which the figure expresses,
" in the third the number of hundreds, and so on.
" When in any rank a figure is wanting, write a cipher
" like a small circle 0 to preserve the rank. Thus ten
" is written 10 ; a hundred 100 ; five thousand and
" twenty-five 5025."

Of the *Indian* Algebra in its full extent the *Arabians* seem to have been ignorant ; but it is likely they had their Algebra from the same source as their Arithmetic. The *Arabian* and *Persian* treatises on Algebra, like the old *European* ones, begin with the Arithmetic, called in those treatises the Arithmetic of the *Indians,* and have a second part on Algebra ; but no notice is taken of the latter. Most likely their Algebra, being numeral, was considered by the authors as part of Arithmetic.

Though part only of the *Khulásat-ul-Hisàb* is about

Algebra, the rest, relating to Arithmetic and Mensuration, must be thought not wholly unconnected with the subject. It is to be hoped that ere long we shall have either translations from the *Sanscrit* of the *Bíja Ganita* and *Lílawati*, or perfect accounts from the originals; and that other ancient *Hindú* books of Algebra will be found, and made known to the world. But, as there is no immediate prospect of these desiderata being realized, the translations into *Persian* will be found well deserving of attention. Only let them be examined without prejudice.

There are principles which will safely lead to a distinction of what is interpolated from what is original; and it is the neglect of these principles, and not any fair examination of the translations, that may lead to error.

IV.

An Account of the Funeral Ceremonies of a Burman Priest.

COMMUNICATED

BY WM. CAREY, D. D.

THE manner in which different nations dispose of their dead is one of those circumstances which have been thought worthy of peculiar notice by all who have studied the history of man, as it is in most instances connected with the idea which they entertain respecting a future state.

Those nations, who believe in the doctrine of the resurrection, practise inhumation. The *Hindoos* and other nations who believe the doctrine of the metempsychosis, and consider fire as the element which purifies all things, usually burn their dead, with a variety of ceremonies suited to those religious notions which are peculiar to the different sects. The inhabitants of *Thibet*, differing from most other nations, either totally neglect the bodies of their dead, or treat them in a manner which to us appears highly barbarous.

The *Burmans* burn their dead like the *Hindoos*, though with a great difference in the method and the attendant ceremonies. With them, the wood of the coffin

(which is made larger and stronger than with us) is nearly all the fuel used to consume the bodies of the common people. The priests, or *Poongees*, are, like them, burnt by the wood of their own coffins; but the fire is communicated by means of rockets. As this is a very singular practice, and has not been noticed by any writer which I have met with, I take the liberty to communicate to the *Asiatick* Society the following account of the funeral ceremonies of a *Poongee* or *Burman* priest, as communicated by my son, Mr. Felix Carey, who resides at *Rangoon*, and was an eye-witness thereto.

"The man whose funeral ceremonies I am going to describe died about two years ago. After the death of a *Poongee*, the body is embalmed in the following manner: First, the intestines are taken out; after which the body is filled with spices of different kinds, and the opening sewed up. A layer of wax is then laid all over the body, so as to prevent the admission of air; upon that is put a layer composed of *lac* and some other ingredients, and the whole covered over with leaf-gold. The body of this person was stretched out at full length, with the arms laid over the breast. When one of these people dies, the body is thus prepared at the house where he died. After about twelve months the corpse is removed to a house built for that purpose, where it is kept a year or two longer, till the *Poongees* order it to be burnt. At one of these places I saw the body of this man, about a month before it was taken out for the purpose of being destroyed. It was then placed upon a stage, which was in a house made like one of their *Kuims**, rising in a conical form, and about thirty feet in height. The stage

* This is the name of the buildings occupied by the *Burman* priests, who live in societies subject to the chief of the *Kuim*, who is distinguished by his age or learning. The *Kuims* are a sort of colleges, where instruction is given to any one who wishes for it; but the members are subject to a discipline not very different from that of a monastery.

was made of bamboos and wood, and the house which contained it was covered with paper, and overlaid with leaf-gold. By the side of this stage lay the coffin in which the body was to be carried out; this also was overlaid with gold, and ornamented with several figures, designed to represent death in a variety of forms. In the court-yard two large four-wheeled carriages were preparing, one to carry the coffin, and the other the stage with its apparatus. The carriage in which the corpse was to be drawn had another stage built upon it, similar to the one in the house, only it was larger, and fixed upon an elephant, made in a kneeling posture.

When the time for the ceremony approached, the principal people of every street were commanded each to prepare a rocket, and an image (the shape of some animal), to which the rocket was to be fixed. Besides these large rockets, a great number of smaller ones were also prepared, as well as other fireworks. The *Burman* new year began either on the 13th or 14th of April (I do not exactly remember which), when the festival celebrated by sprinkling of water commenced, which would have continued six or seven days, had not the viceroy put a stop to it, to admit of the burning of this *Telapoy*. On the 17th, the figures to which the rockets were to be fastened were drawn in procession round the town; and from this day to the end of the ceremony, all the people of the town and its vicinity, both male and female, were compelled to assist. The figures were drawn in procession, one after another, in the following order: First, six or eight flags were carried; these were followed by a number of dancing boys and girls; then the carriages with the figures, some drawn by boys, and others by bullocks, followed; and after them went a number of young women, dancing and singing, with an older woman between each row, to keep them in order. Women were never known to attend such processions before, but this was done in consequence of a particular order from

the viceroy. On this occasion even the wives and daughters of the principal officers of government were obliged to dance, some with umbrellas held over them, and others under an awning large enough to shade forty or fifty persons, and supported by six or eight men; last of all followed the men in like manner, singing, clapping their hands, and dancing, with two men between each row to keep them in order.

The people of each street attended their own carriages, and in this manner proceeded round the town, one company after another. The figures were very large, much larger than the animals they were intended to represent. Some of them were representations of buffaloes, others of bulls, lions, bears, elephants, horses, or men. There were not less than thirty, of a very large size, about thirty feet in height, and a great number of smaller ones.

The next day was spent in drawing the body of the *Poongee* in his carriage, backwards and forwards, or rather in pulling against each other. All the people, being divided into two parties, drew the corpse, from the place where it formerly was, to an extensive valley, near the hill where it was to be burnt. In the front of the valley the viceroy had a temporary house erected, from which he could view the whole show. Four cables were fastened to the axletree of the carriage, two each way; these were held by the people, who every now and then uttered a loud shout, and pulled both ways at the same time. That day neither party gained any advantage over the other, till near evening, when one of the cables broke, and the opposite party gained the victory.

The following day they discharged the large rockets. Early in the morning they carried all the figures and their rockets from the town, and each of these figures was fixed upon a carriage of four wheels, and the rockets were secured, by rattan loops, to strong ropes, which passed

between the feet of the animal, so that, when discharged, they, sliding on the ropes, ran along the ground. Some of these rockets were from seven to eight feet in length, and from three to four in circumference, made of strong timber, and secured by iron hoops, and rattan lashings. The last of them, when discharged, ran over a boy of ten or twelve years old, who died in a few minutes; three or four grown-up persons were also much hurt. Towards evening a great number of fireworks were discharged, which made a very fine appearance.

The next day was the time appointed for blowing up the corpse. On this occasion, a quarrel arose between the two parties who had pulled the former day, the party which had been unsuccessful insisting that the cables had been cut, and not broken, by the opposite party; they therefore presented a petition to the viceroy, requesting that they might have another trial at pulling. This was granted; upon which, having procured four new *European* cables from the ships in the harbour, they recommenced their trial of strength; however, the party which had been victorious before won again, and broke the cables of the other. The unsuccessful party was not yet satisfied, but insisted on another trial of strength the following day. That day neither party obtained the victory, upon which the viceroy issued an order to stop the contest, and to burn the *Telapoy* the next day, which was accordingly done.

That day the corpse was burnt in a temporary house, erected for that purpose, in the shape of a *Kuim*, with a stage in it upon which the coffin was set to be burnt. This was performed with small rockets, fixed upon ropes with rings of rattan, so as to slide along them, from the top of a hill, to the coffin, which was placed on the top of another hill. The rockets, being discharged, slided along the ropes, over the intermediate valley, to the coffin, which was set on fire by them, and, with its contents, quickly consumed.

V.

An Account of Observations taken at the Observatory near Fort St. George, in the East Indies, for determining the Obliquity of the Ecliptic, in the Months of December, 1809, *June and December,* 1810.

By Captain JOHN WARREN,

Of His Majesty's 33d Regiment of Foot.

1. ALTHOUGH the diminution of the obliquity of the ecliptic be a question of a general nature, and in that respect not immediately within the scope of the researches of the *Asiatick* Society; yet if we advert to the opinion of a celebrated mathematician*, "that it is only "within the torrid zone, and near to the equator, that "the obliquity of the ecliptic can be observed with great "precision," the subject may be deemed to fall within their province, and to be deserving of their attention.

2. No observation of this kind has been, I believe, made in *India* (or at least given to the public) since Mr. Le Gentil visited *Pondicherry*, in the years 1768-9. Nor do I think that any instrument of sufficient power for that purpose had reached this country until the government of *Fort St. George* were pleased to purchase and intrust to my hands a circular instrument made by Cary, in the year 1807; which, being used with proper

* Vide Bougaen's Figure de la Terre, page 230.

attention, and some degree of skill, proved perfectly adequate to the purpose. This will appear from the consistency and regularity of the observations and results which form the subject of this paper.

3. This instrument, being intended for astronomical and geographical observations in all cases where angular distances may be the object, is on that account somewhat complex. But I shall confine my description to its means and powers for taking altitudes.

4. The vertical circle is 18 inches in diameter, and is divided in a masterly manner on the limb to fifteen minutes. In order to read the intermediate parts there are two microscopes, fixed horizontally on *Brachiæ*, consisting of a horizontal and an oblique ladder-bar, meeting at an angle somewhat acute, to where the microscope is suspended, the other ends being screwed against the conic pillar which supports the axis of the circle on that side.

5. This mode of suspending the microscope (though perhaps sufficient for northern countries) is rather defective for tropical climates; for, after using this instrument upwards of ten months, I perceived the absolute impossibility of trusting to the level alone for very fine observations, and saw the necessity of a constant reference to a horizontal mark, placed at a convenient distance, for accurate results. This irregularity compelled me to reject the solstitial observations which I had taken in December, 1808, and June, 1809, and is to be accounted for from the great expansion to which the intense heat of these climates subjects every kind of metal. It is true that this cannot be supposed to affect the adjustment within the limits of an observation; but I never observed twice at the distance of an hour without having occasion to alter by some seconds the micrometers, when set to the horizontal mark.

6. The microscopes which read on opposite points of the circle are of the usual construction, and contain micrometers, the heads of which are divided to 2″ of a degree, and by estimation read to one. The wires inside act as in all such instruments, one as a fixed, the other as a moveable wire.

7. There is but one level, which answers for all adjustments. It is suspended on two short arms, projecting from the horizontal axis of the circle, and is exquisitely sensible; the tube hangs freely, so that the air-bubble remains upwards, whatever be the position of the circle. This level is supplied with the proper adjusting screws, and perfectly competent for its purpose, subject to the checks to which I had recourse.

8. The error of centring is very trifling, and is variable. I never observed it at its maximum to exceed 3″. The error of collimation has frequently varied from accidents, or other causes; but since I referred to an horizontal mark this became of no sort of importance, because, previous to every observation, the moveable wires were always set at *zero* against the mark. The thickness of the wire in the focus of the telescope (which subtends nearly 6″) is considered in the altitudes*, by observations of opposite limbs.

9. The successive observations were taken as is usual, with the limb of the circle facing alternately east and west; and latterly care was taken, that, previous to letting the light in, it should be equally heated, which was done by inverting it from the position it was in during the morning, a short time before the sun's passage over the meridian.

* In place of wires, a large spider's web, found in numbers in the *Coorg* country, is made use of. It is exquisitely delicate: it is perhaps extraordinary, that it should have been found, on a great number of observations, to subtend so considerable a quantity.

10. Immediately before observing I set the micrometers at *zero*, the horizontal wire being on the mark; and immediately after taking the altitude I renewed the operation. Between these two readings there seldom was a difference above 2″. The mean was always registered.

11. The instrument is placed on the centre granite pillar in the observatory, and is in every respect perfectly fixed and steady. The temperature was always noticed at the time of observation, with a view to the refraction, which was computed (without reference to the tables) from BRADLEY's *Formula*, and with the constant quantities given in my paper on the declination of stars, published in the XIth Vol. of the *Asiatick* Researches. The sun's declination used for the reductions, and also for the latitudes, was invariably interpolated for the exact moment, from the tables given in the Ephemerides. The parallax was taken for the month, and day, from BRADLEY's tables, given in CALLET's *Logarithms*.

12. The *Brahmin* assistant, SANEVASA-CHAIRY, always observed the transit of the sun whilst I was taking its meridional altitude, which formed also a powerful check against any irregularity which might have crept in from the instrument being disturbed from the meridian when I elevated the telescope. How far these precautions have succeeded will best be shewn by what follows.

PARTICULARS OF OBSERVATIONS.

13. I stated above, that, from want of sufficient knowledge of my instrument, I had been under the necessity of rejecting the solstitial obvervations which I had taken in December, 1808, and June, 1809; these receding rather too wide, for deducing from them the obliquity of the ecliptic. It was only in December fol-

lowing that I obtained sufficient checks over the irregularities I have noticed, for relying on the powers of my instrument. But then the weather proved generally unfavourable, and I obtained but a few unobjectionable observations, two of which only were sufficiently near the solstice for the present purpose, and on which alone I would not have trusted the fate of the present paper, though the mean result agrees within 2″ of all subsequent sets.

14. Observations of the sun's altitude in December, 1809.

	20th.	23d.
Obs'd Altitude of ☉'s Lower Limb,	53 13 14.88	53 12 38.30
Refraction	— 35.30	— 35.50
	53 12 39.58	53 12 2.80
Parallax	+ 5.12	+ 5.12
	53 12 44.70	53 12 7.92
☉'s Semidiameter	+ 16 17.40	+ 16 17.60
Cor'd Altitude ☉'s Centre	53 29 2.10	53 28 25.52
	90	90
Zenith Distance	36 30 57.90	36 31 34.48

The sun entered ♑ on the 21st of December, at 16H. 38M., to which instant the above zenith distances are to be reduced, by interpolating for the maximum of the declinations given in the ephemerides for the 19th, 20th, 21st, and 22d, and comparing this quantity* with the declination

*Maximum of Declination on 21st,	23° 27′ 43″.136	23 27 43.136
Declination on 20th..........	23 26 50.600	23 27 26.640
Differences	52.536	16.496

due to the 20th and 23d at noon, *Madras* time, or 19th and 22d, $18^{H.}\ 38'\ 46''$ *Greenwich* time.

15. Observations of the sun's altitude in June, 1810.

	17th	22d.	26th.
Obs'd Altitude of ☉'s Lower Limb	79 25 41.25	79 20 44.09	79 24 15.99
Refraction	— 8.55	— 8.70	— 8.58
	79 25 32.70	79 20 35.39	79 24 7.41
Parallax.............	+ 1.42	+ 1.55	+ 1.54
	79 25 34.12	79 20 36.94	79 24 8.95
☉'s Semidiameter......	+ 15 46.10	+ 15 45.90	+ 15 45.60
Cor'd Altitude ☉'s Centre,	79 41 20.22	79 36 22.84	79 39 54.55
	90	90	90
Zenith Distance........	10 18 39.78	10 23 37.16	10 20 5.45

The ☉ entered ♋ on the 21st of June, at $15^{H.}\ 54^{M.}$, *Greenwich* time, therefore proceeding as above we have*

Zenith Distances	10 18 39.78	10 23 37.16	10 20 5.45
Reduction	4 55.92	0.16	3 30.07
Observations reduced to 21st	10 23 35.70	10 23 37.32	10 23 35.22
			10 23 37.32
			10 23 35.70
Mean Zenith Distance reduced to the 21st ..			10 23 36.186

* Maximum of Declination	23 27 42.44	23 27 42.44	23 27 42.44
Declinations	23 22 46.52	23 27 42.28	23 24 12.37
Differences	4 55.92	0.16	3 30.07

16. Observations of the sun's altitude in December, 1810.

	20th.	21st.	22d.
Obs'd Altitude ☉'s Upper Limb	53 46 7.30	53 45 19.56	53 12 26.39 LL.
Refraction	— 34.67	— 34.48	— 35.29
	53 45 32.63	53 44 45.08	53 11 51.10
Parallax	+ 4.90	+ 4.90	+ 5.02
	53 45 37.53	53 44 49.98	53 11 56.12
☉'s Semidiameter	— 16 17.45	— 16 17.50	+ 16 17.55
Cor'd Altitude ☉'s Centre	53 29 20.08	53 28 32.48	53 28 13.67
	90	90	90
Zenith Distance........	36 30 39.92	36 31 27.52	36 31 46.33

The ☉ entered ♑ on the 21st of December, at 32[H.] 31[M.], *Greenwich* time; therefore, repeating the preceding process, we have*

	20th.	21st.	22d.
Zenith Distance........	36 30 39.92	36 31 27.52	36 31 46.33
Reduction	1 6.05	0 19.10	0.48
	36 31 45.97	31 31 46.62	36 31 46.81
			36 31 46.62
			36 31 45.97
Mean Zenith Distance reduced to the 21st ..			36 31 46.466

* Maximum of Declination,	23 27 41.92	23 27 41.92	23 27 41.92
Declinations	23 26 35.87	23 27 22.82	23 27 41.44
Differences	1 6.05	19.10	0.48

17. We now proceed to deduce the apparent obliquity of the ecliptic from what precedes.

		°	′	″ ‴
Zenith Distance, 21st of December, 1809		36	31	50.42
———— 21st of June, 1810		10	23	36.11
	Distance of Tropics	46	55	26.53
	Half sum, or apparent Obliquity	23	27	43.26
	Solar Nutation*	+		51
Obliquity for the middle of 1810		23	27	44.17
Zenith Distance, 21st of June, 1810		10	23	36.11
———— 21st of December, 1810		36	31	46.28
	Distance of Tropics	46	55	22.39
	Half sum, or apparent Obliquity	23	27	41.19
	Solar Nutation	+		51
Obliquity for the beginning of 1811		23	27	41.70
Obliquity for July 1st, 1810, N. A.		23	27	42.12
———— by Observation		23	27	44.17
	Difference	+		2.05
Obliquity for January 1st, 1811, N. A.		23	27	41.48
———— by Observation		23	27	42.10
	Difference	+		0.28

* For the solar nutation we have the following formula. Let the sun's longitude = L. The solar precession = P. The obliquity of ecliptic = Obl. N = the nutation. Then,

$$N = \text{Sin.}^2 L \times \frac{\text{Sin. Obl.}}{90} \times \frac{P}{4} = \text{Sin.}^2 L \times \frac{0.4341}{1.570} \times 3''.628 = \text{Sin.}^2 L \times 1'', \text{ nearly,}$$

and when L = 90°, then Sin.² = 1, and N = 1″ nearly. Doctor VINCE makes it 1″ in the winter, and 0″.7 in the summer solstice, the mean of which is 51‴.

18. As the mean obliquity of the ecliptic, and the quantities of its diminution, can only be deduced with accuracy from a great number of observations of the apparent obliquity taken at different times and places, and at considerable intervals, I shall not detain the reader with this last reduction, but present this paper to astronomers in *Europe*, as an ingredient which may be combined with others, for the resolution of this important problem; being at the same time in hopes, that the advantage which I have had of observing between the tropics may balance the inaccuracies which (notwithstanding the utmost care in taking the altitudes) may have crept into my observations.

Of the Latitude of the Madras Observatory, deduced from 100 *Observations of the Sun's Meridional Altitude.*

19. These observations are given in the tables at the end, with the respective elements which have served for obtaining the latitude. The mean limit of the results is 6″. The power of the instrument may therefore be taken at 3″ on each side of the mean, and any observation diverging by more than double that quantity on either side (6″) may justly be rejected as affected by some error independent of the instrument. This I have done in the course of the present series.

20. It will appear remarkable, that the mean latitude derived from 100 unobjectionable observations (48 of which were taken when the sun was either on or near the zenith) should give the latitude of the observatory by 7″ 43‴ less than the stars. This difference is further confirmed by 76 observations of the sun, taken with the zenith sector at different times at the observatory. What follows will shew the comparison.

		°	′	″ ‴
With Major LAMBTON's Zenith Sector.	56 Observations within 8° of the Zenith, in 1803....	13	4	5.29
	20 Observations of do. very near the Zenith, in 1807	13	4	4.20
With CARY's Circle.	100 Observations, the details of which are given in tables I., II., III., and IV.	13	4	6.43
	Mean, by 176 observations....	13	4	5.30
With the Z. Sector.	Latitude by 500 observations of 52 Stars, within 8° of the Zenith	13	4	13.17
	Difference			7.46

21. MR. LE GENTIL, who observed the obliquity of the ecliptic at *Pondicherry*, in the year 1769, remarks, that his observations of the pole star gave the latitude by 5″ 43‴ less than the sun, which he considers as a proof of the correctness of the elements he has used in the reduction of his observations. With due deference to the ingenuity of so eminent an astronomer, I beg to observe that the pole star, which is so little elevated under the parallel of *Pondicherry*, was not a fit object of comparison, on account of the great refraction due to it at 10° and 13°, altitude*. I shall propose Regulus in preference, which is on the sun's path, and, being only 9° 14′ north of the zenith of the observatory, is not subject to any sensible error of refraction.

22. Now it will appear by table 1, of my paper above quoted, that Regulus gave 13° 4′ 13″.434 for the

* I have taken 14 altitudes at the superior transit of the pole star, with CARY's circle, the limits of which are 8″.6; that is, the extremes 4″.3 from the mean. The mean superior altitude was observed 14° 51′ 36″.826, which, by using BRADLEY's refraction (3′ 32″.274), gives the latitude 13° 4′ 7″.33‴. This result is perfectly consistent with the present observations. But as I had no observation of the inferior altitude, and as I did not refer at that period to a horizontal mark, I omit for the present giving the particulars relating to it, though I believe the results cannot be far removed from the truth.

latitude of the observatory; and, by the present, that 48 observations of the sun, when near the zenith, brought out 13° 4′ 6″.484. Hence the difference is 6″.95; not far different from Mr. LE GENTIL's quantity, but with a contrary sign, so that we differ in this respect by 12 ; but in the far more important object of the obliquity, it will appear that we agree as near as could be expected.

23. On the probable cause why the sun should so constantly give a lower latitude than the stars, I can only repeat what I have said formerly in the paper above referred to, namely, that, from allowing too much for the effects of refraction, astronomers in *Europe* assign probably too great a zenith distance to the sun, by which excess they place their zenith too far from the ecliptic, a circumstance which tends necessarily to depress the results of observations of the sun, taken in low latitudes.

JOHN WARREN.

Honourable Company's Observatory,
1st of February, 1811.

Errata in the Paper on the Declination of Stars, published in the XIth Volume of the Asiatick Researches. Table Vth, 3d Column, corresponding Latitudes.

⊙ N.	*for*	13°	4′	2″.207	*read*	13°	4′	2″.879
⊙ S.	*for*	13	4	4.499	*read*	13	4	5.403
Column 4th.	*for*	13	4	3.323	*read*	13	4	4.181

THESE differences arise from the latitudes having been reduced, without interpolating the sun's declination for the respective days; which has been done in the present correction. This alteration, however, affects nothing of what I have said in the 26th article of the paper, because I only considered the observed zenith distances, and not the latitudes.

TABLE I.

Containing the observed Altitudes of the Sun, when near the Zenith of the Madras Observatory, in the Years 1809 *and* 1810.

Twelve Observations of the Sun, in April and May, 1809.

ARTICLE I.

Day of the Month.	Face	Observed Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	☉'s Semidiameter.	☉'s Declination.	Latitude.
		° ′ ″	INCHES.	°	″ —	″ +	′ + ″	° ′ + ″	° ′ ″
April 14	E.	S. 85 40 23.07	29.870	87.7	3.309	0.60	15 57.7	9 16 45.500	13 20 27.439
19	E.	87 26 39.52	29.844	88.8	1.860	0.342	15 56.3	11 2 57.810	13 20 23.508
							—	—	
May 1	E.	N. 88 6 33.40	29.758	92.0	1.743	0.315	15 53.3	14 57 56.450	13 20 21.722
5	E.	87 27 24.27	29.760	88.0	2.291	0.419	15 52.44	16 8 50.957	13 20 20.915
14	E.	84 32 17.13	29.854	94.0	4.628	0.842	15 48.9	18 32 23.786	13 20 20.030
16	E.	84 3 39.935	29.836	86.0	5.107	1.880	15 50.2	19 1 0.040	13 20 26.038
									13 20 24.275
N. B. These observations, and the following, were taken without reference to a horizontal mark.									12 47 48.409
								Mean	13 4 6.342
April 20	W.	S. 88 20 1.97	29.824	88.0	1.579	0.292	15 56.05	11 23 41.100	12 47 44.427
							—		
25	W.	89 59 24.68	29.894	88.0	0.229	0.000	15 54.80	13 4 19.828	12 47 49.479
								—	
May 2	W.	N. 87 15 53.35	29.820	92.0	1.990	0.365	15 53.90	15 16 3.648	12 47 48.273
3	W.	86 58 2.70	29.852	87.0	2.259	0.405	15 52.87	15 33 54.850	12 47 48.566
4	W.	86 40 27.64	29.797	85.0	2.506	0.448	15 52.65	15 51 31.348	12 47 49.580
							+		
6	W.	86 6 3.77	29.746	92.0	2.953	0.539	15 52.22	16 25 56.557	12 50 48.133
Error of collimation, 18′ 42″.067. Affected of the error of centring.								Mean	12 47 48.409

Twelve Observations of the Sun, in August, 1809.

ARTICLE II.

Day of the Month.	Face	Observed Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	☉'s Semidiameter.	☉'s Declination.	Latitude.
		° ′ ″	INCHES.	°	″ —	″ +	′ + ″	° ′ — ″	° ′ ″
Aug.......12	E.	N. 87 57 36.34	29.896	88.0	1.891	0.298	15 49.2	15 7 7.29	13 20 31.237
14	E.	88 33 48.73	29.892	89.0	1.394	0.211	15 49.5	14 30 51.99	13 20 29.037
17	E.	89 30 10.295	29.772	91.0	0.621	0.075	15 50.0	13 34 32.93	13 20 32.679
								+	
19	E.	S. 89 51 13.63	29.794	86.0	0.343	0.025	15 50.5	12 55 53.99	13 20 31.178
22	E.	88 19 58.75	29.830	87.0	1.779	0.024	15 50.1	11 56 27.35	13 20 40.255
24	E.	87 39 22.15	29.798	88.0	2.081	0.341	15 51.5	11 15 51.48	13 20 39.570
									13 20 33.992
									12 47 39.337
								Mean	13 4 6.6645
11	W.	N. 87 6 46.70	29.884	88.0	2.135	0.425	15 49.0	15 25 7.67	12 47 41.660
13	W.	87 42 43.92	29.914	88.0	2.161	0.373	15 49.4	14 49 11.17	12 47 42.702
18	W.	89 16 26.69	29.798	85.0	0.371	0.107	15 50.3	13 15 20.23	12 47 37.026
21	W.	S. 89 12 0.60	29.834	86.0	0.232	0.114	15 50.9	12 16 27.99	12 47 36.608
23	W.	88 32 47.53	29.794	88.0	0.983	0.213	15 51.1	11 36 15.12	12 47 37.260
26	W.	87 30 26.35	29.770	87.0	1.810	0.360	15 51.96	10 33 57.63	12 47 40.770
								Mean	12 47 39.337

Error of collimation, 18′ 32″.662.
Affected of the error of centring.

Twelve Observations of the Sun, in April and May, 1810.

ARTICLE III.

Day of the Month.	Face	Observed Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	⊙'s Semidiameter.	⊙'s Declination.	Latitude.
		° ′ ″	INCHES.	°	″ —	″ +	′ + ″	° ′ + ″	° ′ ″
April 18	E.	S. 87 16 49.80	29.736	86.5	2.219	0.40	15 56.7	10 36 49.80	13 4 5.119
20	E.	87 58 27.35	29.714	87.5	1.647	0.31	15 56.2	11 18 31.00	13 4 8.787
22	E.	88 39 26.85	29.706	86.5	1.093	0.21	15 55.6	11 59 26.71	13 4 5.143
24	E.	N. 89 19 35.70	29.668	87.0	0.547	0.11	15 55.2	12 39 36.12	13 4 5.057
								—	
May 2	E.	87 36 38.85	29.646	87.8	1.937	0.36	15 53.2	15 11 35.53	13 4 6.003
4	E.	87 1 0.92	29.690	89.0	2.416	0.45	15 52.7	15 47 12.666	14 4 4.320
									13 4 5.738
									13 4 7.754
N. B. These Observations and the following were taken with reference to a horizontal mark.								Mean	13 4 6.746
								+	
19	W.	S. 87 37 49.80	29.736	86.5	1.933	0.34	15 56.4	10 57 49.80	13 4 5.193
21	W.	88 18 58.25	29.702	86.8	1.371	0.26	15 55.8	11 39 4.32	13 4 11.381
23	W.	88 59 35.35	29.684	86.5	0.820	0.16	15 55.4	12 19 37.52	13 4 7.430
								—	
27	W.	N. 89 41 47.32	29.672	88.0	0.245	0.06	15 54.4	13 38 17.73	13 4 11.475
29	W.	88 31 52.54	29.708	87.2	1.194	0.23	15 53.9	14 16 19.52	13 4 4.996
May 1	W.	87 54 41.39	29.646	87.0	1.696	0.32	15 53.4	14 53 32.64	13 4 6.054
Error of collimation, 1″.008.								Mean	13 4 7.754

Twelve Observations of the Sun, in August and September, 1810.

ARTICLE IV.

Day of the Month.	Face	Observed Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	☉'s Semidiameter.	☉'s Declination.	Latitude.
		° ′ ″	INCHES.	°	″ −	″ +	′ + ″	° ′ − ″	° ′ ″
August.... 2	E.	N. 84 50 45.47	29.562	92.0	4.140	0.60	15 47.63	17 57 34.970	13 4 4.930
12	E.	87 36 43.89	29.656	90.2	1.930	0.35	15 49.13	15 11 35.560	13 4 7.000
15	E.	88 31 23.24	29.616	88.0	1.190	0.22	15 49.70	14 16 52.340	13 4 4.310
								+	
17	E.	89 9 2.03	29.622	87.0	0.680	0.13	15 50.1	13 39 12.600	13 4 4.180
21	E.	S. 89 1 23.150	29.568	87.0	0.700	0.15	15 50.9	12 21 21.320	13 4 7.820
23	E.	88 21 14.170	29.546	88.7	1.330	0.24	15 51.3	11 41 13.520	13 4 9.120
									13 4 6.226
									13 4 6.145
Mean of the four Latitudes, 13° 4′ 6″.4843.								Mean	13 4 6.185
								−	
August.... 1	W.	N. 84 35 43.23	29.542	91.8	4.340	0.76	15 47.5	18 12 37.380	13 4 4.53
11	W.	87 18 53.61	29.646	88.8	2.170	0.27	15 48.96	15 29 22.760	13 4 3.53
14	W.	88 12 52.80	29.636	86.2	1.250	0.37	15 49.5	14 35 21.250	13 4 2.32
								+	
20	W.	S. 89 21 9.67	29.634	86.8	0.540	0.10	15 50.7	12 41 8.730	13 4 8.80
24	W.	88 0 52.73	29.544	87.7	1.600	0.20	15 51.5	11 20 52.900	13 4 9.98
September 1	W.	85 15 0.89	29.464	88.8	3.760	1.05	15 53.2	8 31 59.09	13 4 7.71
Error of collimation, 0″.045.								Mean	13 4 6.145

TABLE II.

Containing Observations of the Sun's Altitude, when near the Solstices.

Ten Observations of the Sun, in June, 1810.

ARTICLE I.

Day of the Month.	Face	Observed Altitude.	Baro-meter.	Thermo-meter.	Refrac-tion.	Paral-lax.	☉'s Semidia-meter.	☉'s Declination.	Latitude.
		° ′ ″	INCHES.	°	″ −	″ +	′ + ″	° ′ − ″	° ′ ″
June......13	E.	N. 79 37 0.70	29.560	92.0	8.40	1.51	15 46.3	23 11 25.50	13 4 5.61
15	E.	79 30 32.11	29.472	91.8	8.48	1.53	15 46.2	23 17 55.43	13 4 6.89
17	E.	79 25 41.25	29.472	91.0	8.55	1.54	15 46.1	23 22 46.52	13 4 6.86
22	E.	79 20 44.09	29.546	88.0	8.70	1.55	15 45.9	23 27 42.28	13 4 5.12
26	E.	79 24 15.99	29.504	91.0	8.58	1.54	15 45.6	23 24 12.37	13 4 6.92
28	E.	79 28 27.81	29.482	82.9	8.67	1.54	15 45.6	23 19 59.22	13 4 5.50
								Mean	13 4 6.15
June 14	W.	N. 79 33 37.26	29.520	92.4	8.44	1.52	15 46.3	23 14 52.251	13 4 8.89
25	W.	79 22 46.46	29.528	88.8	8.66	1.55	15 45.7	23 25 41.71	13 4 6.76
27	W.	79 26 12.36	29.526	91.0	8.56	1.54	15 45.6	23 22 17.95	13 4 8.89
29	W.	79 31 8.98	29.465	87.5	8.54	1.54	15 45.6	23 17 15.88	13 4 3.46
									13 4 7.00
									13 4 6.15
Error of collimation, 0″.42.								Mean	13 4 6.575

Ten Observations of the Sun, in December, 1810, and January, 1811.

ARTICLE II.

Day of the Month.		Face		Observed Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	☉'s Semidiameter.	☉'s Declination.	Latitude.
				° ′ ″	INCHES.	°	″ —	″ +	′ + ″	° ′ — ″	° ′ ″
Dec.......	13	E.	S.	54 4 42.16	29.672	81.5	34.150	4.86	16 16.9	23 7 58.22	13 4 6.11
	21	E.		53 45 23.22	29.714	83.1	34.480	4.90	16 17.5	23 27 22.82	13 4 4.79
	26	E.		53 48 29.44	29.654	80.2	34.490	4.89	16 17.7	23 24 12.97	13 4 4.89
										+	
1811.	28	E.		53 20 44.50	29.670	78.0	35.180	5.01	16 17.75	23 19 39.47	13 4 8.45
Jan.	3	E.		53 45 12.25	29.668	81.8	34.280	4.90	16 17.77	22 54 46.71	13 4 7.63
	6	E.		54 36 36.00	29.814	78.0	33.930	4.74	16 17.72	22 36 8.72	13 4 2.19
											13 4 5.676
Dec.	10	W.	S.	53 47 1 94	29.080	81.1	34.57	4.92	16 16.6	22 53 2.92	13 4 8.12
1811	22	W.		53 12 26.39	29.682	81.2	35.29	5.02	16 17.55	23 27 41.44	13 4 4.89
Jan.......	4	W.		54 23 36.56	29.772	79.0	34.06	4.80	16 17.75	22 49 0.96	13 4 9.49
	7	W.		54 10 49.10	29.786	78.0	34.43	4.84	16 17.70	22 29 8.94	13 4 10.68
											13 4 8.295
											13 4 5.676
Mean latitude, in December, 1810, and January, 1811,											13 4 6.985
Mean latitude, in June, 1810......................											13 4 6.575
Error of collimation, 1″.307.										Mean	13 4 6.780

TABLE III.

Containing the Observed Altitudes of the Sun, when on or near the Equator, in the Year 1810.

Day of the Month.	Face	Observed Altitude.	Baro- meter.	Thermo- meter.	Refrac- tion.	Paral- lax.	☉'s Semidia- meter.	☉'s Declination.	Latitude.
		° ′ ″	INCHES.	°	″ —	″ +	′ + ″	° N. ′ + ″	° ′ ″
Sept. 3	E.	84 28 23.44	29.428	86.0	4.489	0.21	15 53.70	7 48 16.82	13 4 4.379
7	E.	83 0 26.82	29.542	91.2	5.634	1.03	15 54.70	6 20 24.68	13 4 7.764
9	E.	82 14 31.50	29.496	91.0	6.248	1.14	15 54.20	5 34 19.86	13 4 59.268
12	E.	81 6 4.81	29.564	90.5	7.179	1.31	15 55 95	4 26 2.43	13 4 7.539
15	E.	79 57 3.52	29.551	91.0	8.010	1.50	15 56.75	3 17 3.94	13 4 10.270
17	E.	79 10 48.18	29.554	90.0	8.714	1.60	15 57.27	2 30 45.81	13 4 7.474
								Mean latitude by face E.	13 4 6.1156
Sept. 4	W.	84 6 11.20	29.476	88.0	4.766	0.74	15 53.95	7 66 18.83	13 4 11.706
10	W.	81 51 46.58	29.526	91.8	6.555	1.19	15 55.45	5 11 39 29	13 4 1.625
14	W.	80 20 12.23	29.564	90.5	7.793	1.42	15 56.47	3 40 7.34	13 4 5.013
								Mean latitude by face W.	13 4 6.1143
								——— E.	13 4 6.1156
								Mean latitude,	13 4 6.1199

TABLE IV.

Containing the Observed Altitudes of the Sun, at various Places between the Tropics, in the Year 1809-10.

Day of the Month.	Face	Observed Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	☉'s Semidiameter.	☉'s Declination. N.	Latitude.
1809.		° ′ ″	INCHES.	°	″ −	″ +	′ + ″	° ′ − ″	° ′ ″
Dec. 20	E.	53 13 14.88	29.686	80.0	35.30	5.12	16 17.4	23 26 50.60	13 4 7.30
30	E.	53 27 44.94	29.744	79.8	35.13	5.09	16 17.7	23 12 19.52	13 4 7.88
1810.								+	
March 31	E.	80 35 30.70	29.716	86.2	7.74	1.14	16 1.2	3 55 34.63	13 4 9.030
April 6	E.	82 53 33.50	29.710	87.9	5.801	1.06	15 59.9	6 13 36.76	13 4 8.101
8	E.	83 38 48.70	29.728	86.5	5.200	0.95	15 59.4	6 58 50.28	13 4 6.430
10	E.	84 23 25.50	29.654	87.0	4.570	0.84	15 58.8	7 43 30.25	13 4 9.680
								−	
May...... 4	E.	87 1 0.92	29.690	89.0	2.416	0.45	15 52.7	15 47 12.666	13 4 4.320
8	E.	85 53 4.64	29.586	88.0	3.325	0.61	15 51.8	16 55 13.067	13 4 6.792
10	E.	85 20 46.28	29.628	89.2	3.762	0.69	15 51.3	17 27 37.467	13 4 11.026
17	E.	83 36 54.30	29.584	85.6	5.211	0.94	15 50.0	19 11 24.696	13 4 4.725
22	E.	82 32 24.96	29.502	85.3	6.085	1.10	15 49.0	20 15 55.176	13 4 4.151
								Mean by face E.	13 4 7.307
								Mean by face W.	13 4 7.858
								Mean latitude	13 4 7.582

TABLES IV. *Continued.*

Day of the Month.	Face	Observed Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	☉'s Semidiameter.	☉'s Declination. N.	Latitude.
1809.		° ′ ″	INCHES.	°	″ —	″ +	′ + ″	° ′ — ″	° ′ ″
December 23	W	53 13 14.88	29.780	80.0	35.50	5.12	16 17.60	23 27 26.64	13 4 7.840
31	W.	53 31 48.03	29.780	80.9	35.26	5.11	16 17.70	23 8 17.37	13 4 7.050
1810.								+	
April 5	W.	82 30 43.60	29.648	87.5	6.094	1.11	16 0.20	5 50 50.56	13 4 11.744
11	W.	84 45 43.90	29.694	87.4	4.271	0.78	15 58.60	8 5 45.19	13 4 6.181
13	W	85 29 40.90	29.648	86.5	3.670	0.67	15 58.00	8 49 40.98	13 4 5.080
15	W.	86 12 55.58	29.708	86.7	3.085	0.57	15 57.50	9 32 57.30	13 4 6.815
17	W.	86 55 42.95	29.672	86.5	2.501	0.43	15 57.0	10 15 48.60	13 4 10.721
								—	
May 3	W.	87 18 48.28	29.678	88.0	2.179	0.41	15 53.00	15 29 31.259	13 4 10.770
5	W.	86 43 40.10	29.638	86.9	2.661	0.49	15 42.50	16 4 37.065	13 4 7.494
7	W.	86 9 33.71	29.598	88.0	3.166	0.58	15 52.00	16 38 39.267	13 4 2.391
9	W.	85 36 44.3	29.620	88.9	3.551	0.65	15 51.6	17 11 34.557	13 4 7.556
21	W.	82 44 44.46	29.533	83.0	5.940	1.70	15 49.3	20 3 41.318	13 4 10.658
								Mean by face W.	13 4 7.858

VI.

On the Notions of the Hindu *Astronomers, concerning the Precession of the Equinoxes and Motions of the Planets.*

BY H. T. COLEBROOKE, ESQ.

IN an essay on the *Indian* and *Arabian* divisions of the Zodiac, inserted in the Ninth Volume of the *Asiatick* Researches, I adverted to a passage of BHA'SCARA, on the precession of the equinoxes, and intimated an intention of further noticing this subject in a separate essay*. The passage, which I had then in view, occurs in BHA'SCARA's description of the armillary sphere†. It appears to me deserving of distinct examination for the information which it contains, the difficulties which it presents, and the variety of topicks which it suggests. I shall here quote the original, and add a verbal translation.

विषुवत्क्रान्तिवलययोस्सम्पातःक्रान्तिपातःस्यात्
॥ तद्भगणाःसौरोक्ता व्यस्ता अयु तत्रयङ्कल्पे ॥ १७ ॥
अयन चलनं यदुक्तंमुञ्जालाद्यैस्सएवायं ॥ तत्पक्षेतद्भ
गणाकल्पेगोंगर्तु नन्दगोचन्द्राः ॥ १८ ॥

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* As. Res. vol. 9, p. 353.
† *Góládhyáya*, C. 6. V. 17 and 18.

"The intersection of the ecliptic and equinoctial
" circles is the *crántipáta*, or intersecting point of the
" sun's path. Its revolutions, as declared on the autho-
" rity of SU'RYA *(Sauróctáh)*, are retrograde three
" myriads in a *calpa*. This is the same with the
" motion of the solstice, as affirmed by MUNJA'LA, and
" others. But, according to their doctrine, its revolutions
" are 199,669 in a *calpa*."

This is the very passage to which the commentator on the *Súrya sidd'hánta*, cited by Mr. DAVIS*, alludes, where he says "the meaning of BHA'SCARA A'CHA'RYA
" was not that SU'RYA [in the *Súrya sidd'hánta*] gave
" 30,000 as the revolutions of the places of the colures,
" in a *calpa;* the name he used being *Saura* not *Súrya*,
" and applied to some other book."

It is certainly true, as here observed by this commentator, that BHA'SCARA's quotation does not agree with the text of the *Súrya sidd'hánta*, which expresses,
" The circle of the asterisms moves eastward thirty
" scores in a *yuga*. Multiplying the number of elapsed
" days by that, and dividing by the terrestrial days
" [which compose the cycle], the quantity obtained is
" an arc, which, multiplied by three, and divided by ten†,
" gives degrees *(ans'a)*, termed *ayana* [or the place of
" the colure.]"

त्रिंशत्कृत्योयुगेभानांचक्रंप्राक्परिलंबते ॥ तद्गुणा
द्भूदिनैर्भक्ताद्द्युगणाद्यदवाप्यते ॥ तद्दोस्त्रिघ्नादशा
प्तांशाविज्ञेया अयनाभिधा ॥

* As. Res. vol. 2, p. 267.
† Ratio of 27° to 90°.

Here the number of revolutions is 600 in a *yuga*, answering to 600,000 in a *calpa*; and not, as stated by BHA'SCARA, 30,000. But the commentator's mode of reconciling the contradiction, by supposing a different book from the *Súrya sidd'hánta* to have been intended, is incompatible with BHA'SCARA's own explanation of his text, in the *Vásanábháshya*, containing annotations by himself on his own treatise. He there says, in express words, "The revolutions of the intersecting point "of the sun's path are stated in the *Súrya sidd'hánta* as "amounting to 30,000 in a *calpa* *."

अतो ऽस्यक्रान्तिपातस्य भगणाः कल्पे ऽयुतत्रयं तावत्सूर्यसिद्धान्तोक्ताः ॥

His commentator, MUNÍS'WARA, has therefore recourse to other expedients for reconciling the contradiction between BHA'SCARA's quotation and the text of the *Súrya sidd'hánta*. Some, he observes, have proposed to read *niyuta*, "a hundred thousand," for *ayuta*, "a myriad †." Others have supposed the *calpa* to be a twentieth part only of the period usually so denominated. The commentator further suggests the resolution of the term *vyastáh*, translated "retrograde," into *vi* for *vinsáti*, "twenty," and *astáh*, which he makes to signify "multi-

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* BHA'SCARA's *Vásaná Bháshya* on the astronomy and sphericks of his *Sidd'hánta sirómani*. This volume of annotations is commented, with the *Sirómani*, by NRĬSINHA in the *Vásaná Vártica*, as proceeding from the same writer; and is expressly acknowledged to be a work of the author of the text (as it actually purports) by the Scholiast MUNÍS'WARA, in this very place, where he is endeavouring to support his own interpretation of the text against the apparent and natural sense of a passage in the author's notes.

† He alludes either to the *Vásaná vártica*, in which that emendation of the text is actually suggested by the annotator NRĬSINHA, or to some earlier commentary, in which the same conjectural emendation may have been originally proposed.

plied," and expounds the phrase "thirty thousand multiplied by twenty." But, dissatisfied with this, and with another exposition, by which *trayam*, "three," is construed into "sixty," he gives the preference to an equally strained interpretation, which divides the sentence into two members: "Its revolutions are declared by "SU'RYA, and [according to a different authority] are "retrograde three myriads in a *calpa*."

However unsatisfactory these explanations of the text may be, they prove the concurrence of the commentators of both works in the received interpretation of the very obscure passage of the *Súrya sidd'hánta*, which is the subject of their discussion. That interpretation is supported by corresponding passages of the *Sóma sidd'hánta*, *Laghu Vasisht'ha*, and *Sácalya-sanhitá*, in which the number of six hundred revolutions is explicitly stated *: as well as by other quotations, which clearly demonstrate, that a libration of the equinoxes, at the rate of six hundred in a *yuga*, was there meant. For, in all the passages quoted, the revolution, as it is termed, of the equinoctial points, consists in a libration of them within the limits of twenty-seven degrees east, and as many west, of the beginnings of Aries and Libra; and that such

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* युगेषट्शतकृत्वाह्यिभचक्रंप्राग्विलंबते ॥ तद्गुणो भूदिनैर्भक्तोद्युगुणो यनखेचरः । *Sómasidd'hánta.* तत्पश्चाच्चलितंचक्रम् इत्येतदेकंप्रा क्चलनंयुगेता निचषट्शतं ॥ *Sácalyasanhitá.* 1. 286—291. अब्दाःखखर्तुभिर्भाज्यास्तद्दोस्त्रिघ्नादशाहृता ॥ *Laghuvasisht'ha Sidd'hánta*, cited by DA'DA'BHA'Ï and NRÏSINHA, on the *Súrya sidd'hánta*.

is the meaning conveyed in the text of the *Súrya sidd'hánta* is distinctly shown by the commentator cited by Mr. DAVIS *, as well as by the other commentators on that work.

The same doctrine is taught in the *Parás'ara-sidd'hánta*, as quoted by MUNÍS'WARA; and if we may rely on the authority of a quotation by this author from the works of A'RYABHAT'T'A, it was also maintained by that ancient astronomer: but, according to the first-mentioned treatise, the number of librations amounts to 581,709, and, according to the latter, 578,159, in a *calpa*, instead of 600,000; and A'RYABHAT'T'A has stated the limits of the libration at 24° instead of 27° †.

BH'ASCARA himself, adopting the doctrine for which he quotes the authority of MUNJA'LA, in the passage above cited, mentions a complete revolution of the places of the colures through the twelve signs of the Zodiack at the rate of $59^{II}\ 54^{III}\ 2^{IIII}\ 31^{V}\ 12^{VI}$ per annum, or 199,669 complete revolutions in a *calpa*. Having computed upon the same principle the quantity of the precession in his own time at $91{,}189^{rev.}\ 0^{s}\ 10^{\circ}\ 54^{I}\ 35^{II}\ 23^{III}\ 55^{IIII}\ 40^{V}\ 48^{VI}$, he thence, for the sake of facility in calculation, assumes in his practical treatise, named *Caran'a Cutúhala*, the actual precession in whole numbers at eleven degrees, and

* As Res. 2. p. 267. The commentator is *Nrĭsinha*.

† चतुर्विंशत्यंशैश्चक्रमुभयतोगच्छेत् ॥

A'RYABHAT'T'A, in the *A'ryáshtas'ata*, quoted by MUNÍS'WARA. It is especially necessary to distinguish the particular work of this author, to which reference is made: for BRAHMEGUPTA reproaches him for his inconsistency in affirming revolutions of the nodes in the *A'ryáshtas'ata*, which he denied in the *Das'agítaca*. It is therefore probable that the libration of the equinoxes (considered as nodes), for which the first-mentioned work is quoted, may not be stated in the other.

allows the annual motion to be taken at one minute*. The time for which this computation was made is the same with the epocha of the *Caran'a Cutúhala* †; which is the year 1105 *Sáca* ‡, thirty-three years after the *Siróman'i* was completed §.

BH'ASCARA's authority, supporting that of MUNJA'LA, and countenanced by VISHNU' CHANDRA's ||, has not availed with Indian astronomers. Even his commentator, MUNÍSWARA, rejects the notion of a complete revolution; and, in his own treatise, entitled *Sidd'hánta Sárvabhauma*, asserts the doctrine of libration, and attempts to refute the other opinion, not indeed by argument, but in deference to the *Súrya sidd'hánta*, and other authorities to which it is opposed. Upon the same ground, CAMALA'CARA, in the *Siddihánta tatwavivéca*, says, "The degrees of the colures, as stated by "MUNJA'LA, and taught in the *Siróman'i*, contrary to "what is declared by ARCA (SU'RYA) and others, from "not rightly understanding what was by them declared,

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* MUNÍS'WARA, in his commentary on the *S'iróman'i*.

† The *Grahalág'hava*, written in 1442 *S'aca*, deducts 444 from the expired years of the *S'aca*, and divides by 60; reckoning the precession at a minute a year. This agrees nearly with the *Caran'a Cutúhala*: for, if the same number (444) be deducted from the years expired (1105 *S'aca*); the remainder gives but one minute above 11°, the quantity there assumed by BHA'SCARA.

RA'MACHANDRA, who in the *Cálanirn'aya* states the quantity of precession as amounting to 12°, and reckons the precession at a minute of a degree a year, seems also to have followed the same authority. He may therefore have written about sixty years subsequent to the date of the *Caran'a Cutúhala*; or *S'aca* 1165. This ascertainment of the age of RA'MACHANDRA A'CHA'RYA is a step towards investigating the age of writers in other branches of science, who have quoted this author or who are cited by him. They are numerous.

‡ FAIZÍ; in his translation of *Bhdscara's Lílávatí*.

§ For it was finished when the author was thirty-six years of age; and he was born in 1036 *S'aca*, as he informs us.

|| See next page.

"must be rejected by the wise." He certainly here expresses the prevalent opinion of the *Hindu* astronomers, which is decidedly in favour of a libration of the places of the colures.

Besides MUNJA'LA mentioned by BHA'SCARA, the only other ancient author, whose name I find quoted for a complete revolution of the equinoctial and solstitial points, is VISHN'U CHANDRA*, from whose works a passage is cited by PR'ÌT'HU'DACASWA'MI, declaratory of a solstitial *yuga*, or period of the *ayana*. The text is corrupt in respect of the lowest digits of the number; and, having found no other quotation of it, I shall not attempt to state the period from a conjectural emendation of this passage.

It is necessary to observe, that some of the ancient writers on astronomy have not admitted a periodical motion of the equinoxes. This is adverted to by BHA'SCARA himself †, who instances BRAHMEGUPTA. The reason of that omission or denial is supposed by BHA'SCARA ‡ to have been the inconsiderable quantity of the deviation or precession, not then remarkable, and consequently unheeded by BRAHMEGUPTA; since whose time it is become sensible, and therefore it is now taken into account ‖. BHA'SCARA next inquires "why BRAH-

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* Author of the *Vasisht'ha-Sidd'hánta*, a distinct work from the *Laghu-vasisht'ha* cited by DA'DA'BHA"Ì, and (under the title of *Vasisht'ha -Sidd'hánta*) by NRÌSINHA.

† In the *Vásaná bháshya*.

‡ Ibid.

‖ तत्कथंब्रह्मगुप्तादिभिर्निपुणैरपिनोक्त इतिचेत्तत दास्वल्पत्वान्नैनोंपलब्धः इदानोंबहुत्वात्सांप्रतैरुपलब्धः अतएवास्यगतिरस्तीत्यवगतं ॥

MEGUPTA and the rest did not nevertheless state it on the strength of authority, since it had been declared in the *Saura sidd'hánta;* in like manner as the numbers of revolutions, the periphery of epicycles, &c. * ?" He replies, "In mathematical science holy tradition is authority, so far only as it agrees with demonstration." He goes on to say, "Such motion as results from the assigned revolutions, by which places being calculated agree with those which are observed, must be admitted, whether taught by a holy sage or by a temporal teacher. If then the same places are deducible from other revolutions, which of the assigned motions is the true one? The answer is, whichever agrees with present observation must be admitted. But if in process of time the difference become great, then men of genius, like BRAHMEGUPTA, will arise, who will acknowledge such motions as agree with present observation, and compose books (*S'astras*) conformable thereto. Accordingly this mathematical science has no end in eternal time."

But BRAHMEGUPTA'S commentator, expounding a passage of this author †, which he considers to be levelled against those who affirmed a periodical revolution of the solstitial points, and which does deny such a revolution, and declares the solstice to be invariable, because the longest day and shortest night occur constantly at the end of *Mit'huna*, or GEMINI, adverts in the course of

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" Why has it not been stated by BRAHMEGUPTA and other skilful astronomers? It was not perceived by them, because it was then inconsiderable. But it is perceived by the moderns, because it is now considerable. Accordingly it is concluded, that there is motion [of the solstice]." BHA'SCARA in the *Vásaná-bháshya.*

* यद्येवमनुपलब्धोपिसौरसिद्धान्तोक्तत्वादागमप्रा
माण्येनभगणपरिध्यादिवत्कथंतैर्नोक्तः ॥

† Ch. 11.

his exposition of the text to passages which place the southern and northern solstice respectively in the middle of *As'lés'há* and beginning of *Dhanisht'há;* and proceeds to remark "this only proves a shifting of the "solstice, not numerous revolutions of it through the "ecliptic." His notion appears then to have been, that his author was aware of the fact of a change in the positions of the solstitial and equinoctial points, but did not admit the inference that the motion must be periodical.

From all that has been said, it appears that some of the most celebrated astronomers, as BRAHMEGUPTA, have been silent on the subject of a change in the places of the colures, or have denied their regular periodical motion; that others, as MUNJA'LA and BHA'SCARA (we may add VISHN'U CHANDRA), have asserted a periodical revolution of the places of the colures; but that the greater number of celebrated writers, and all the modern *Hindu* astronomers, have affirmed a libration of the equinoctial points.

The earliest known author, who is cited for the support of this doctrine, as far as present research has gone, is A'RYABHAT'T'A, who is undoubtedly more ancient than BRAHMEGUPTA, for he is repeatedly quoted in the *Brahme Sphúta-sidd'hánta,* which is ascribed to BRAMEGUPTA; and which there is every reason to consider genuine, since the text of the book accords with the quotations from that celebrated astronomer to be found in treatises of various dates.

I purposely omit in this place the *Súrya-sidd'hánta, Sóma, Sácalya, Vásisht'ha,* and *Párásara,* because their authenticity and age are subjects of question or of controversy.

Relying then upon the quotation from the work of A'RYABHAT'T'A, and on the tendency of BHA'SCARA'S

observations both in his text and notes, it may be inferred that the notion of a libration of the equinoxes is of some antiquity in India; since BRAHMEGUPTA, by whom A'RYABHAT'T'A is repeatedly mentioned, is either author or republisher of an astronomical system, which was copied by BHA'SCARA in 1150, A. D., but which is adapted to a much earlier age.

The doctrine in question found advocates formerly among the astronomers of Europe and of Arabia. ARZAEL, a Spaniard, and a mathematician of the 11th century*, author of a treatise entitled Observations on the Obliquity of the Zodiac, affirmed a libration or trepidation in longitude within the limits of 10° E. and W., at the rate of a degree in 75 years†. Two centuries after him, THEBITH BEN KHORA, an astrologer ‡, assigned to this supposed trepidation the limits of 22° E. and W§. To the same astrologer, by some supposed to have lived as much earlier as he is here stated to have been later, a different doctrine is ascribed, affirming a motion of the intersected points of the ecliptic and equinoctial in a small circle described with the radius of 4° 18′ 43″||.

They were led to that hypothesis (according to a remark quoted by the authors who have refuted the notion¶) by considering that " HERMES had found some of the fixed stars more distant from the beginning of Aries than PTOLEMY subsequently did: for instance, the bright

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* He observed the quantity of the obliquity of the ecliptic about the year 1070; and is named by ABRAHAM EBN EZRA, who wrote in the 12th century (A. D. 1144 or 1150), as anterior to him by 71 years.—*Riccioli Almag. nov.*

† Riccioli Almagestum novum 3.28.6.

‡ Moreri, Dict.

§ ERASMUS REINHOLD on Purbach; Ricc. Almag. nov. 3.28.6.

|| Montucla, Hist. des Math. 1.34.6.

¶ Augustinus Riccius de Motu Octavæ Sphæræ, Regiomontanus, lib. 7. Epitomes Almagesti. Ricc. Alm. nov. 3.28.6.

star of Hydra in 7° of Leo, placed by PTOLEMY in 30° of Cancer; and the star named Vultur Cadens, in 24° of Sagittarius, but by PTOLEMY in 17°."

The notion of a trepidation in longitude, but at a rate not equable, had been entertained by the astronomers who compiled the Alphonsine Tables, though ALPHONSUS himself was subsequently led to the adoption of a correcter opinion, and to the consequent alteration of the tables first published by him*.

The earliest mention of a libration in longitude, which has been found in any Arabick writer, is in the work of MUHAMMED BEN JABER, surnamed ALBA'TANÍ, and by us called ALBATEGNIUS. This celebrated astronomer, an Arabian by birth and Sabian by religion, flourished at the end of the ninth century†; or, to speak with precision, about the year of Christ 879 ‡; and from him we learn, that certain astronomers, whom he does not appear to have any where named, had before him affirmed a libration of the fixed stars within the limits of 8° E. and W. at the rate of a degree in 80 or 84 years §. He himself maintained the doctrine of an uniform motion, at the rate of a degree in 66 years ||.

I have dwelt the longer upon the history of this opinion, because it appears to me deserving of attention on more than one account. ALBA'TANÍ is the earliest of the Arabian astronomers who improved upon PTOLEMY (for ALFARGA'NI, who was a century earlier, is not cited as correcting the Greek astronomer on this point).

* ABRAHAM ZAGUTHUS; cited, like the preceding authorities, in Riccioli's Almagest. 3.28.6.

† D'Herbelot, Bibl. Orient.

‡ He himself furnishes the date, being the year 1627 of the era of NABONASSAR. Albategn. c. 51, cited in Riccioli's Almagest. 6.16.2.

§ Albategnius, c. 52, as cited by Riccioli.

|| Ibid c. 51.

It was he, then, who first, among the astronomers of the west of Asia, computed the motion of the stars at a degree in 66 years; which is almost the same with the rate of the motion of trepidation according to the *Súrya sidd'hánta*, and the herd of *Hindu* astronomers, who reckon a degree and a half in a century *. He is the first also, as far as can be discovered, in whose works mention is made of a motion of trepidation: and we may be permitted to conjecture that the earlier astronomers alluded to by him were *Indian*, since we find A'RYABHAT'T'A, an author seemingly of an earlier age, quoted for a libration of the equinoctical points within the limits of twenty-four degrees, at the rate of one in 78 years; and since we know that an Arabian astronomer, anterior by nearly a century to ALBA'TANÍ, had compiled tables in conformity to rules of astronomy apparently *Indian*†.

We may then safely conclude, that, on the subject of the precession of the equinoxes, the *Hindus* had a theory, which, though erroneous, was their own; and which, at a subsequent time, found advocates among the astronomers of the west. That they had a knowledge of the true doctrine of an uniform motion in antecedentia, at least seven hundred years ago‡, when the astronomers of Europe also were divided on the question. That they had approximated to the true rate of that motion much nearer

* This is the rate resulting from the quantity of the motion in trepidation stated in the *Súrya sidd'hánta:* and the same results from the rules of calculation given in the *Bháswatí-carana* of SATANANDA, and in the *Játacárnava*, improperly ascribed to VARA'HA-MIHIRA. They both direct the number 421 to be deducted from the expired years of *S'aca;* and the one deducts a tenth, and reduces the remainder into degrees; the other adds half, and divides by a hundred. Another rule, producing the same result, is mentioned in BAILLY's Ast. Ind. p. 76.

† "Ad Regulos Send Hend." (*Sidd'hánt?*) Abulfarag. Hist. Dynast. p. 114 and 161; COSTARD's Astronomy, p. 157; and Montucla Hist. des Math. p. 344.

‡ BHA'SCARA, who quotes MUNJA'LA, completed the *Siroman'i* in 1072, *S'aca*, or A. D. 1150.

than PTOLEMY, before the Arabian astronomers, and as near the truth as these have ever done since. From this we may perhaps be led to a further conclusion, that the astronomy of the *Hindus* merits a more particular examination than it has yet obtained: not indeed with any expectation of advancing the science of astronomy, which needs not such aid, and can derive none from the labours of astronomers who have recorded no observations; but for the history of the science, and ascertainment of the progress which was here made: and that, with this view, the works of *Hindu* astronomers, whose age is precisely known, and in particular those of BHA'SCARA, which contain a complete course of astronomy, and of sciences connected with it, should be carefully perused; as well as those of BRAHMEGUPTA, which are full of quotations from earlier astronomers, as A'RYABHAT'T'A*, VA'RA'HAMIHIRA†, S'RI'SHE'N'A‡, VISHN'U CHANDRA§, and some others, who are cited by him for the purpose of exposing and correcting their errors.

In regard to VA'RA'HAMIHIRA and the *Súrya sidd'hánta*, both separately quoted in the *Brahme-sphut'a-sidd'hánta* of BRAHMEGUPTA, I may here remark, that a book entitled *Súrya sidd'hánta* is mentioned by VA'RA'HAMIHIRA himself, in his most undoubted work, the treatise on astrology entitled *Várâhi-sanhitá*, where, describing the qualifications requisite to form an accomplished astrologer, he says, "The astrologer should be "conversant with divisions of time and geometrical "figures, as taught in the five *Sidd'hántas*, or systems of "astronomy, called *Paulisa*, *Rómaca*, *Vasisht'ha*, *Saura*,

* Author of the *Das'agíticá* and *A'ryáshta sata*.
† Named with censure by BRAHMEGUPTA.
‡ Author of the *Rómaca sidd'hánta*.
§ Mentioned as the author of the *Vasisht'ha sidd'hánta*.

" and *Paitámaha**." VA'RA'HAMIHIRA, as appears from the quotations of his own commentator BHAT'T'ÓTPALA, and many other astronomical writers, is likewise author of a treatise entitled *Pancha-sidd'hanticá*, in which the five systems abovementioned are compared; and, as far as can be gathered from quotations, their agreements and disagreements noticed. A passage of this treatise, as cited by BHAT'T'ÓTPALA, is sufficiently remarkable to be here inserted, since it bears relation to the subject of this paper. It corresponds in import to a passage quoted by Mr. DAVIS, and Sir W. JONES†, from the 3d chapter of the *Váráhisanhitá*, but refers the actual position of the colures to the asterisms instead of the signs of the zodiac.

अश्लेषार्द्धादिासीद्यदा निवृत्तिः किलोष्णकिरण
स्य ॥ युक्तमयनंतदासीत्सांप्रतमयनंपुनर्वसुतः ॥

" WHEN the return of the sun took place from the " middle of *Asléshá*, the tropick was then right. It now " takes place from *Punarvasu*."

The same five systems of astronomy, from which VA'RA'HAMIHIRA is understood to have compiled the astronomical treatise just now quoted, and which are named by him in the passage of his astrology before cited, are mentioned by BRAHMEGUPTA also as stand-

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* तत्रग्रहगणितेपौलिसरोमकवासिष्टसौरपैतामहे
षुपंचस्वेतेषुसिद्धान्तेषुयुगवर्षायनर्तुमासपक्षाहोरा
त्रयाममुहूर्तनाडीप्राण त्रुटित्रुट्याद्यवयवस्य काल
स्यक्षेत्रस्य चवेत्ता ॥

† As. Res. 2d vol. p. 391.

ard authorities, and enumerated by him in the same order; and his names, which are precisely the same with those in VA'RA'HAMIHIRA's enumeration*, are explained by BHAT'T'ÓTPALA, as intending the *Pulis'a-sidd'hánta, Rómaca-sidd'hánta, Vas'isht'ha-sidd'hánta, Súrya-sidd'-hánta,* and *Brahme-sidd'hánta.*

All these books are frequently cited in astronomical compilations, and are occasionally referred to their real or supposed authors. The first is every where assigned to PULIS'A, or PULISHA, whose name it bears. The *Rómaca-sidd'hánta* is ascribed by the scholiast of BRAHMEGUPTA, and by a commentator of the *Súrya-sidd'hánta,* to S'RI'S'E'N'A or S'RI'S'HE'N'A (for the name is variously written). The *Vásisht'ha-sidd'-hánta* is by the same authority given to VISHN'UCHANDRA. Both these authors are repeatedly mentioned with censure by BRAHMEGUPTA; and it is acknowledged that they are entitled to no particular deference.

The *Brahme-sidd'hánta,* which is the basis of BRAH-

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* पौलिषरोमकवासिष्ठसौरपैतामहेषु यत्प्रोक्तंतन्नक्षत्रानयनंनार्यभटोक्तं तदुक्तिरतः ॥

This passage, in which the *Paulisha, Rómaca, Vásisht'ha, Saura,* and *Paitámaha,* are specified, is introductory to a division of the lunar asterisms (for astrological purposes, it should seem), in unequal portions, by allotting to fifteen of them a quantity equivalent to the mean diurnal motion of the moon in minutes of a degree (790′ 35″); and half as much more to six of those asterisms (1185′ 52″), and so much less to the like number of *nacshatras* (395′ 17″); and assigning the complement of the circle (254′ 18″) to the supplementary *nacshatra,* called *Abhijit.*

(☞ The numbers here set down are copied from the scholiast BHAT'T'O'TPALA, and from BHA'SCARA's commentators; being stated by them at the nearest second: for the moon's mean daily motion, according to BRAHMEGUPTA and BHA'SCARA, is a little less than 790′ 35″.)

MEGUPTA's work, is not any where attributed to a known author; but referred, in all quotations of it which have fallen under observation, either to the *Vishnu d'hermóttara Purán'a,* of which it is considered as forming a part; or to BRAHME (also called PITA'MAHA), who is introduced into it as the speaker in a dialogue with BHRIGU; or it is acknowledged to be the work of some unknown person *. The true author it may be now impracticable to discover, and would be vain to conjecture.

The *Súrya-sidd'hánta* (if the same which we now possess) is in like manner ascribed to no certain author, unless in the passage cited by our colleague, Mr. BENTLEY †, who says, that, "in the commentary on the *Bháswatí*, it is declared, that VARA'HA was the author of the *Súrya-sidd'hánta;*" and who adds, that "SATA'NAN'DA, the author of the *Bháswatí,* was a pupil of VARA'HA, under whose directions he himself acknowledges he wrote that work."

The concluding remark alludes to the following verse of the *Bháswatí-carana.*

अथप्रवक्ष्येमिहिरोपदेशात्तत्सूर्य्यसिद्धान्तसमंसमासात् ॥

"Next I will propound succinctly, from MIHIRA's "instruction, [this system] equal to the *Súrya-sidd'hánta.*"

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* DA'DA'BHA'Í, in his commentary on the *Súrya-sidd'hánta*, says so.

पैतामहमपिकेनचिन्निबद्धंतस्योपरिब्रह्मगुप्तेनपैतामहीभाष्यंनिबद्धं तदपिपौरुष्यं ॥

† As. Res. vol. 6. p. 572.

It is preceded by an introductory couplet, which will be found quoted at the foot of the page *, or is omitted in some copies: but the correct reading, as appears from collation of text and scholia, retains both.

Admitting then its authenticity, and supposing, with most of the commentators, that VA'RA'HAMIHIRA is here intended by the single word *Mihira*, which, however, is a name of the sun, and may here allude to the fabled dialogue of SU'RYA with MEYA, as is observed by the scholiast BALABHADRA †; still the passage is not unambiguous. It does not necessarily imply oral tuition, and may refer to instruction derived from the works of VAR'A'HA; especially from the *Pancha-sidd'hántica* of that author, in which the *Súrya-sidd'hánta* was explained concurrently with four other treatises, termed *Sidd'hánta.*

To return from this digression. It appears, from what had been before said, that a work bearing the title of *Súrya-sidd'hánta* is named as authority by VA'RA'HAMIHIRA, in whose time, according to his assertion, the place of the summer solstice was at the beginning of the

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* नत्वामुरारेश्चरणारविंदंश्रीमान्सतानंदइतिप्रसिद्धः तांभास्वतींशिष्यहितार्थमाहशाकेविहीनेशशिपक्षखैके ॥

"Having bowed to the foot of the foe of MURA, the fortunate SATA'NANDA propounds, for the benefit of students, the *Bháswatí*, in the *S'aca* year 1021."

The author SATA'NANDA, as he himself informs us in the close of the book, was an inhabitant of *Purushóttama* (the site of the temple of *Jagannát'ha*): and dates his work there in 4200 of the *Caliyuga*. In the body of the work he directs the difference of longitude to be reckoned from the meridian of *Purushóttamacshétra.*

† His commentary is dated in 1465 of VICRAMA'DITTYA; more than 400 years ago.

sign *Carcata*, and in the asterism *Punarvasu*. A treatise under the same title is similarly mentioned by BRAHMEGUPTA, who has likewise noticed VA'RA'HAMIHIRA himself, and who is supposed by BHA'SCARA to have lived when the colures had not sensibly deviated from that position.

It may be questioned whether this testimony be not overthrown by proofs of a more modern date (between seven and eight hundred years ago), drawn from internal evidence, as set forth by Mr. BENTLEY, in his ingenious essays inserted in the 6th and 8th Volumes of our Researches*.

Without entering at present into any disquisition on this subject, or discussing the accuracy of the premises, but acceding generally to the position, that the date of a set of astronomical tables, or of a system for the computation of the places of planets, is deducible from the ascertainment of a time when that system or set of tables gave results nearest to the truth; and granting that the date above mentioned approximates within certain limits to such an ascertainment; I shall merely observe, that, supposing the dates otherwise irreconcilable, still the book, which we now have under the name of *Súrya*, or *Saura, Sidd'hánta*, may have been, and probably was, modernised from a more ancient treatise of the same name, the later work borrowing its title from an earlier performance of a different author. We have an instance of this practice in the kindred case of the *Brahme-sidd'hánta*: for we are acquainted with no less than three astronomical treatises bearing this title; one extracted from the *Vishn'udhermóttara*, another termed the *Sácalya*, and the third the *Sphut'a-sidd'hánta* of BRAHMEGUPTA; and an equal number of tracts, entitled *Vasisht'ha-sidd'-*

* Vol. 6, p. 572, and Vol. 8, p. 206.

hánta, may be traced in the quotations of authors; one by VISHN'UCHANDRA; another termed *Laghu-vasisht'ha*, which, from its name, should be an abridgment; and the third, apparently an ample treatise, distinguished as the *Vrïdd'ha-vasisht'ha*. This solution of the objection also is entirely compatible with the tenour of the references to the *Saura*, which have been yet remarked in the works of BRAHMEGUPTA and VA'RA'HAMIHIRA; none of them being relative to points that furnish arguments for concluding the age of the book from internal evidence.

At all events, whatever may be thought of the *Súrya-sidd'hánta*, we have the authority of a quotation from A'RYABHAT'T'A, to show that the *Hindus* had ascertained the quantity of the precession more correctly than PTOLEMY; and had accounted for it, by a motion in libration or trepidation, before this notion was adopted by any other astronomer whose labours are known to us.

It appears also, from a passage of BRAHMEGUPTA's refutation of the supposed errors of that author, and from his commentator's quotation of A'RYABHAT'T'A's text, that this ancient astronomer maintained the doctrine of the earth's diurnal revolution round its axis. "The sphere of the stars," he affirms, "is stationary; and the earth, making a revolution, produces the daily rising and setting of stars and planets*. BRAHMEGUPTA answers, "If the earth move a minute in a *prán'a*, then whence and what route does it proceed? If it revolve, why do

* भपञ्जरः स्थिरो भूरेवावृत्यावृत्य प्रातिदैवसिकौ उदयास्तमयौ संपादयति नक्षत्रग्रहाणाम् ॥

A'RYABHAT'T'A, cited by PRĬT'HU'DACA.

not lofty objects fall*?" But his commentator, PRIT'HU'DACA SWA'MÍ, replies, "A'RYABHAT'T'A's opinion appears nevertheless satisfactory, since planets cannot have two motions at once; and the objection, that lofty things would fall, is contradicted; for, every way, the under part of the earth is also the upper: since, wherever the spectator stands on the earth's surface, even that spot is the uppermost point."

We here find both an ancient astronomer and a later commentator† maintaining, against the sense of their countrymen, the rational doctrine which HERACLIDES of *Pontus*, the Pythagorean ECPHANTUS, and a few others among the Greeks, had affirmed of old, but which was abandoned by the astronomers both of the east and of the west, until revived and demonstrated in comparatively modern times‡.

BRAHMEGUPTA is more fortunate in his reasoning where he refutes another theory of the alternation of day and night imagined by the *Jainas*, who account for the diurnal change by the passage of two suns and as many moons, and a double set of stars and minor planets, round a pyramidical mountain, at the foot of which is this habitable earth. His confutation of that absurdity is copied by BHA'SCARA, who has added to it, from PRIT'HU'DACA's gloss on a different passage of BRAHMEGUPTA, a refutation of another notion ascribed by him to the same sect, respecting the translation of the earth in space.

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* प्राणेनैतिकलांभूर्यदितत्कुतोव्रजेत्कमध्वानम्।
आवर्त्तनमर्वाक्चेन्नपतन्तिसमुच्छ्रायाःकस्मात्॥

Brahme-sphuta-sidd'hánta.

† The commentator wrote at least seven centuries ago; for he is quoted by BHA'SCARA in the text and notes of the *S'iróman'i.*

‡ For an outline of A'RYABHAT'T'A's system of astronomy, see a note at the close of this essay.

This idea has no other origin than the notion, that the earth, being heavy and without support, must perpetually descend; and has therefore no relation whatever to the modern opinion of a proper motion of the sun and stars.

Part of the passage of BHA'SCARA has been quoted in a former essay*. What regards the further subject now noticed is here subjoined.

'The earth stands firm, by its own power, without other support, in space.

'If there be a material support to the earth, and another upholder of that, and again another of this, and so on, there is no limit. If, finally, self-support must be assumed, why not assume it in the first instance? why not recognise it in this multiform earth?

'As heat is in the sun and fire, coldness in the moon, fluidity in water, hardness in iron; so mobility is in air, and immobility in the earth, by nature. How wonderful are the implanted faculties!

'The earth, possessing an attractive force†, draws towards itself any heavy substance situated in the surrounding atmosphere, and that substance appears as if it fell. But whither can the earth fall in ethereal space, which is equal and alike on every side?

'Observing the revolution of the stars, the *Baudd'has*‡ acknowledge that the earth has no support; but, as nothing heavy is seen to remain in the atmosphere, they thence conclude that it falls in ethereal space.

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* As. Res. Vol. 9, p. 322.

† Like the attraction of the loadstone for iron. *Maríchi* on BHA'SCARA.

‡ Meaning the *Jainas*, as appears from the author's own annotation on this passage.

'Whence dost thou deduce, *O Baudd'ha,* this idle notion, that, because any heavy substance thrown into the air falls to the earth, therefore the earth itself descends*?'

He adds this farther explanation in his notes: 'For, if the earth were falling, an arrow shot into the air would not return to it when the projectile force was expended, since both would descend.—Nor can it be said that it moves slower, and is overtaken by the arrow; for the heaviest bodies fall quickest, and the earth is heaviest.'

It has been observed, in a former part of this essay, that BRAHMEGUPTA's treatise of astronomy is founded on an anterior one, entitled *Bráhma-sidd'hánta:* and the authenticity of the book extant under BRAHMEGUPTA's name has been relied upon, and passages have been freely cited from it, as the genuine performance of that ancient astronomer. These matters appear to be of sufficient importance to deserve a more particular explanation of their grounds.

The source, from which BRAHMEGUPTA drew, is indicated by the author himself, in his introductory couplet, cited by LACSHMÍDA'SA in the commentary on BHA'SCARA†;

ब्रह्मोक्तग्रहगणितंमहताकालेनयत्‌खिलीभूतम्‌ ।
अभिधीयतेस्फुटंतत्‌जिष्णुसुतब्रह्मगुप्तेन ॥

which, in a literal version, will stand thus: "The computation of planets, as declared by BRA'HMA, and "become imperfect by great length of time, is perspicu-

* *Sirómáni Góládhyaya,* c. 1. v. 2. 4. 7. and 9.
† The *Gánita tatwa Chintámanì,* dated in 1423 Saca, or 1501 A.D.

" ously *(Sphut'a)* explained by BRAHMEGUPTA, son " of JISHNU."

The ambiguity imputable to this passage is obviated by the more explicit terms of the initial stanza of his 11th Chapter, where BRAHMEGUPTA announces a refutation of opinions opposed to the *Bráhma-sidd'hánta*.

येज्ञानपटलाच्छन्नदृशोन्यद्ब्राह्माद्वदन्तिसिद्धान्तात् ।
तेषां युगादिभेदाद्येदोषास्तान्प्रवक्ष्यामि ॥

" I will refute the errors (respecting the yugas and other matters) of those who, misled by ignorance, maintain things contrary to the *Bráhma-sidd'hánta*."

What the work is, to which BRAHMEGUPTA refers under the title specified by him, and corresponding to a subsequent mention by him of the *Paitámaha-sidd'hánta* (both titles being of the same import), is explained by the scholiasts of BHA'SCARA and of the *Súrya-sidd'hánta*. NRÍSINHA, a commentator on both texts*, affirms that BRAHMEGUPTA's rules are formed from the *Vishn'ud'hermóttara-purán'a*, in which the *Brahme-sidd'hánta* is contained†; BHA'SCARA's commentator, MUNÍSWARA‡, remarks, that BRAHMEGUPTA, having verified by observation the revolutions stated in the *Bráhma-sidd'hánta*

* He is author of a commentary on the *Súrya-sidd'hánta*, and of the *Vásaná Vártica* on BHA'SCARA's text and notes. It is dated in 1543 *S'aca*, or 1621 A. D.

† As. Res. vol. 2. p. 242.

‡ Author of the *Máríchi* on BHA'SCARA's *S'irómani*, and of a distinct treatise of astronomy, the *Sidd'hánta Sárvabhauma*. The earliest copy of the *Máríchi* is dated 1560 *S'aca* (A. D. 1638), which is not much later than the date of the work itself; for the Emperor NU'RUDDIN JEHANGIR is mentioned at the close of the book, as he also is in the preface of a commentary on the *Súrya-sidd'hánta* by the author's father, RANGANA'T'HA.

of the *Vishnu-d'hermóttara,* and having found them suitable to his own time, adopted these numbers, rejecting the revolutions taught by SU'RYA, and the rest. In other places the commentator cites parallel passages from BRAHMEGUPTA, and the *Bráhma* (also termed by him *Paitámaha*) *sidd'hánta* of the *Vishn'u-d'hermóttara* *; and these, with numerous quotations from BRAHMEGUPTA in the *Chintámani*, and in other commentaries on BHA'SCARA, as well as in the author's notes on his own text, are exactly conformable with the *Brahme-sphuta-sidd'hánta* now in my possession, and which is accompanied by the gloss of BRAHMEGUPTA's celebrated commentator, CHATURVE'DA PRĬT-HU'DACA SWAMÍ.

It appears then, from a collation of the passages so cited,

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* Take the following as examples :—

1st. The number of sidereal days in a *Calpa* (viz. 1582236450000), which the *Paitámaha-sidd'hánta* of the *Vishnud'hermóttara*, cited in *Maríchi*, ch. 1) expresses by these words :—

चत्वारिशुन्यानिपंचवेदरसाग्नियमपक्षाष्टशरेन्द
व: कल्पेनप्रति नक्षत्रोदया:

and BRAHMEGUPTA renders by the equivalent terms, परिवर्ता
खचतुष्टयशराब्धिरसगुणयमद्विवसुतिथय: ॥

2d. The commencement of the *Calpa*, on Sunday, 1st Chaitra, at the moment of sunrise on the meridian of *Lancá*, which the *Bráhma-sidd'hánta* of the *Vishn'u-d'hermóttara-purána* (Marichi, ch. 2) thus expresses : लंकायामर्कोदयेचैत्र शुक्लप्रतिपदारंभेर्कदि
नादावश्विन्यादौकिंस्तुघ्नादौरौद्रादौकालप्रवृत्तिः ॥

and BRAHMEGUPTA by the following couplet :—

चैत्रसितादेरुदयाद्भानोर्दिनमासवर्षयुगकल्पा: ।
सृष्ट्यादौलंकायां समंप्रवृत्तादिनेर्कस्य ॥

that BRAHMEGUPTA's work is, at least in part, a paraphrase of the BR'AHMA or PAITA'MAHA, containing, however, additional matter: and it is accordingly termed, by one of the scholiasts of the *Súrya-sidd'hánta**, a commentary on the *Paitámaha*; and CHATURVE'DA's gloss is denominated, by the same scholiast, an interpretation of the *Paitámahi-bháshya*.

In support of what has been here said, I shall adduce a few instances of quotation on subjects possessing some degree of interest.

The first is one in which BHA'SCARA vindicates a passage of BRAHMEGUPTA from the objections of his commentator, quoting the passage itself in his notes, and there naming the scholiast, CHATURVE'DA; from which, be it remarked, the commentary is ascertained to be anterior to BHA'SCARA's work: I have a further reason, however, for citing the passage, as it furnishes occasion for some observations on the *Indian* theory of Astronomy.

The *Hindus*, as is well known, place the earth in the centre of the world, and make the Sun and Moon and minor Planets, revolve round it, apparently in concentrick orbits, with unequal or irregular motion. For a physical explanation of the phænomena, they imagine the planets driven by currents of air along their respective orbits (besides one great vortex carrying stars and planets, with prodigious velocity, round the earth, in the compass of a day). The winds or currents impelling the several planets communicate to them velocities, by which their motion should be equal, and in the plane of the ecliptick; but the planets are drawn from this course by certain controlling powers, situated at the apogees, conjunctions, and nodes.

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* DA'DA'BHAJ, see p. 29.

These powers are clothed by *Hindu* imaginations with celestial bodies invisible to human sight, and furnished with hands and reins, by which they draw the planets from their direct path and uniform progress. The being at the apogee, for instance, constantly attracts the planet towards itself (alternately, however) with the right and left hands. The deity of the node diverts the planet, first, to one side, then to the other, from the ecliptick. And, lastly, the deity at the conjunction causes the planet to be one while stationary, another while retrograde, and to move at different times with velocity accelerated or retarded. These fancied beings are considered as invisible planets; the nodes and apogees having a motion of their own in the ecliptick.

This whimsical system, more worthy of the mythologist than of the astronomer, is gravely set forth in the *Súrya-sidd'hánta:* and even BHA'SCARA gives into it, though not without indications of reluctant acquiescence; for he has not noticed it in his text, and only briefly in his notes.

To explain, on mathematical principles, the irregularity of the planetary motions, the *Hindu* astronomers remove the earth from the centre of the planet's orbit, and assume the motion in that eccentrick to be really equable, though it appear irregular as viewed from the earth. Another hypothesis is also taught by them, according to which the planet revolves with an equal but contrary motion in an epicycle, of which the centre is carried with like but direct motion on a concentrick orbit.

BH'ASCARA remarks that both theories are equivalent, giving the same results in computation: but he maintains that the planet's motion in an eccentrick orbit *(pratimandala)* is consonant to the truth; and the other

hypothesis of an epicycle (*nichóchcha-vrĭtta*) is merely a device for the facility of computation.

Both theories, with certain modifications, which will be subsequently noticed, suffice for the anomaly of the Sun and Moon. To account for the still greater apparent irregularities of the five minor planets, the *Hindu* astronomers make them revolve with direct motion on an epicycle borne on an eccentrick deferent. (In the case of the two inferior planets, the revolution in the eccentrick is performed in the same time with the Sun: consequently the planet's motion in its epicycle is, in fact, its proper revolution in its orbit. In the instance of the superior planets, on the contrary, the epicycle corresponds in time to a revolution of the Sun; and the eccentrick deferent answers to the true revolution of the planet in its orbit.)

So far the *Indian* system, as already remarked by Mr. DAVIS in his Treatise on the Astronomical Computations of the *Hindus**, agrees with the *Ptolemaick*. At the first glance it will remind the reader of the hypothesis of an eccentrick orbit devised by HIPPARCHUS; and of that of an epicycle on a deferent, said to have been invented by APOLLONIUS, but applied by HIPPARCHUS. At the same time the omission of an equant (having double the eccentricity of the deferent), imagined by PTOLEMY for the five minor planets, as well as the epicycle with a deferent of the centre of the eccentrick, contrived by him to account for the evection of the Moon,—and the circle of anomaly of eccentricity, adapted to the inequality of MERCURY's motions,—cannot fail to attract notice.

The *Hindus*, who have not any of PTOLEMY's additions to the theory of HIPPARCHUS, have introduced a different modification of the hypothesis, for they give an

* As. Res. vol. 2. p. 250.

oval form to the eccentrick or equivalent epicycle, as well as to the planet's proper epicycle. That is, they assume the axis of the epicycle greater at the end of the *(sama)* even quadrants of anomaly, (or in the line of the apsides and conjunctions,) and least at the end of the *(vishama)* or odd quadrants (1st and 3d), and intermediately in proportion*. This contrivance of an oval epicycle is applied by certain astronomers to all the planets; and by others is restricted to few; and by some is altogether rejected. A'RYABHA'T'T'A, for example, and the *Súrya-sidd'hánta*, make both epicycles of all the planets oval, placing, however, the short axis of the proper epicycles of Jupiter and Saturn in the line of mean conjunction, termed by ***Hindu*** astronomers their quick apogee *(Sighróchcha)*. BRAHMEGUPTA and BHA'SCARA, on the contrary, acknowledge only the epicycles of Mars and Venus to be oval, and insist that the rest are circular. The author of the *Sidd'hánta Sárvabhauma* goes a step further, maintaining that all are circular, and taking the mean between the numbers given in the *Súrya-sidd'hánta*.

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* Rad: Sine of Anomaly :: Diff. between circles described on greatest and least axis: diff. between circles described on greatest axis and on the diameter of the epicycle for the proposed anomaly. Whence the circle described on that diameter is determined; and is used for the epicycle in computations for that anomaly. Since circles are to each other as their Radii, the proportion above stated answers to the following; semitransverse axis: diff. between transverse and conjugate semiaxis :: ordinate of the circle: a fourth proportional; which is precisely the difference between that ordinate and an ordinate of the ellipse for the same absciss. Hindu astronomers take it for the difference between the Radius of the circumscribed circle and the semidiameter of the ellipse at an angle with the axis equal to the proposed anomaly; and, in an ellipsis very little eccentrick, the error is small.

† The epicycles of Mars, according to BRAHMEGUPTA and BHA'SCARA, are increased in six signs and diminished in six other signs of anomaly, by a quantity found by this proportion; sine of 45° : sine or co-sine of anomaly (whichever be the least) :: 6° 40′ : correction additive in six first signs, and subtractive in six last.

Dimensions of the Epicycles in Degrees of the Deferent.

		☉	☾	♂	☿	♃	♀	♄
Epicycle of Anomaly	*Brahmegupta,*	13 40′	31°36′	70° ± 6°40′ †	38°	33°	11° & 9° ‖	30*
	Bháscara,	—	—	— —	—	—	—	50
Circle described on the great axis of the oval epicycle	*Súrya Sidd'hánta*	14	32	75	30	33	12	49
Circle described on the less axis	....	13 40	31 40	72	28	32	11	48
Proper epicycle	*Brahmegupta,*			243 40 ± 6 40 †	132	68	258 &263	‖ 40
Circle on the great axis of the oval epicycle ..	*(Súrya Sidd'hánta)*			235	133	72	262	40
Circle on the less axis................................				232	132	70	260	39

A further difference of theory, though not of practice, occurs among the *Hindu* astronomers, in regard to the curvature of the eccentrick deferents, and the consequent method of computing on the equivalent hypothesis of epicycles.

A reference to Mr. DAVIS's essay *, and to the diagrams which accompany it, will render intelligible what has been already said, and what now remains to be explained. It is there observed, that it is only in computing the retrogradations and other particulars respecting the minor planets that the *Hindus* find the length of the *Carn'a C* ⊕ † (or line drawn from the centre of the earth to the planet's place in the epicycle). In other cases, as for the Anomalistick Equation of the Sun and Moon, they are satisfied to take *hc* as equal to the Sine *lm* ‡ (that is, the Sine of mean anomaly, reduced to its dimensions in the epicycle in parts of the radius of the concentrick, equal to the Sine of the Anomalistick Equation). The reason is subjoined: "The difference, as the commentator on the *Súrya-sidd'hánta* observes, being inconsiderable."

‖ The epicycles of Venus are oval, and the circles described on the transverse and conjugate axis (circles circumscribed and inscribed) are here stated.

* As. Res. vol. 2. p. 249.

† As. Res. vol. 2. p. 250, Diagram, fig. 2.

‡ Ibid.

Most of the commentators on the *Súrya-sidd'hánta* do assign that reason; but some of them adopt BRAHMEGUPTA's explanation. This astronomer maintains that the operation of finding the *Carn'a* is rightly omitted in respect of the eccentricks or equivalent epicycles of all the planets, and retained in regard to the proper epicycles of the minor planets carried by the eccentrick deferents. His hypothesis, as briefly intimated by himself, and as explained by BHA'SCARA, supposes the epicycle, which represents the eccentrick, to be augmented in the proportion which *Carn'a* (or the distance of the planet's place from the earth's centre) bears to the Radius of the concentrick; and it is on this account, and not as a mere approximation, that the finding of the *Carn'a*, with the subsequent operation to which it is applicable, is dispensed with *.

The Scholiast of BRAHMEGUPTA objects to his author's doctrine on this point, that, upon the same principle, the process of finding the *Carn'a*, with the subsequent employment of it to find the Sine of the Anomalistick Equation, should in like manner be omitted in the proper epicycles of the five minor planets; and he concludes, therefore, that the omission of that process has no other ground but the very inconsiderable difference of the result in the instance of a small epicycle. For,

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* For Rad : Periphery of the epicycle : : *Carn'a* : augmented epicycle.
And Circle : Sine of Anomaly : : augmented epicycle : Sine of Anomaly in augmented epicycle.
Lastly *Carn'a* : Sine of Anomaly in augmented epicycle : : Rad : Sine of Anomalistick Equation.

$$\text{Whence Periphery} \ldots\ldots \left\{ \times \frac{\text{Carna}}{\text{Radius}} \times \frac{\text{Rad.}}{\text{Carna}} \times \frac{\text{Sine of Anomaly}}{\text{Circle}} \right\} = \left\{ \begin{array}{c}\text{Sine of}\\ \text{Anomalistick}\\ \text{Equation.}\end{array}\right.$$

$$\text{And, abridging, Periphery} \times \frac{\text{Sine of Anomaly}}{\text{Circle}} = \left\{ \begin{array}{c}\text{Sine of}\\ \text{Anomalistick}\\ \text{Equation.}\end{array}\right.$$

Wherefore Circle : Periphery of Epicycle : : Sine of Anomaly : Sine of Anomalistick Equation.

as remarked by another author *, treating on the same subject, the Equation itself and its Sine are very small near the line of the apsides; and at a distance from that line the *Carn'a* and Radius approach to equality.

BHA'SCARA, in the *S'irómani*, quotes succinctly BRAHMEGUPTA's doctrine, and the Scholiast's objection to it; and replies to the latter; and in his notes in the *Vásaná-bháshya*, cites the text of BRAHMEGUPTA and CHATURVE'DA's reasoning, which he tries to confute. His quotation agrees perfectly with the present text of the *Brahme-sphut'a-sidd'hánta* and commentary of CHATURVE'DA' PRĬTHU'DACA SWA'MÍ, which is annexed to it.

The passage, which has required so much preparatory explanation, is itself short.

त्रिज्याभक्तःकर्णःपरिधिगुणोवादुकोटिगुणकारः
असकृन्मन्देतत्फलमाद्यसमंनात्रकर्णोऽस्मात् ॥

'The *Carn'a*, or longest side of the triangle, multiplied by the Periphery of the Epicycle, and divided by Radius, becomes the multiplier of the Sine and Co-sine of Anomaly. The same result, as before, is obtained by a single operation in the instance of the Anomalistick Epicycle: and therefore *Carn'a* is not here employed.'

BHA'SCARA's words in the *S'irómani* are these: "Some say, that in this system, in the operation of finding the Equation of Anomaly, the *Carn'a*, or long side of the triangle, is not employed, because the difference in the two modes of computation is very inconsiderable. But others maintain, that, if the *Carn'a* be used, the Periphery of the Epicycle must in this operation be corrected,

* In the *Maríchi*.

by multiplying it by *Carn'a,* and dividing by Radius. Wherefore the result is the same as by the former method; and on that account, they say, the *Carn'a* is not employed. It is not to be objected, why is not the same method used in the *S'ighra* Epicycle? For the principles of the two differ.'

In his notes on this part of his text, he cites, as before observed, the precise passage of BRAHMEGUPTA which has been inserted above, and a portion of CHATURVE'DA's comment on it, and names the author.

In another instance BHA'SCARA quotes in his *S'irómani* BRAHMEGUPTA by name, and the commentator by implication (and fuller quotations of both occur in the notes and commentaries), for a disagreement in regard to the latitude of stars and planets measured from the ecliptick, both on a circle drawn through its poles, and on one passing through the poles of the equator, the latter termed *Sphut'a* or apparent, and the other *Asphut'a* or unapparent*. BHA'SCARA remarks, that BRAHMEGUPTA has directed the latitudes of planets to be computed by one mode, and has given those of the stars in the other, but has stated no rule for reducing the latitude of one denomination to the other, or for rectifying the true latitude from the measure given on the circle of declination. The reason he considers to be the little difference between them (which is true in respect of the planets, though not so in the case of most of the stars); and the frequent occasion, in astronomical computations, for the declination of stars, while their proper latitude is not an element in any calculation; whereas, in the case of the planets, both are employed on different occasions: he adverts to a strained interpretation proposed by the

* *Asphut'a Sara* is the true latitude of a star or planet; *Sphut'a Sara* is its declination ± declination of the point of intersection in the ecliptick.

commentator to construe BRAHMEGUPTA's rule as adapted to the same denomination of latitude which is employed by him for the stars. BHA'SCARA refutes that interpretation, and justifies BRAHMEGUPTA's text, taken in its obvious and natural sense.

This passage of the *S'irómani* * confirms what was said by me, from other authority, in a former essay†, concerning the *Hindu* method of determining a star's place, with reference to the ecliptick, by the intersection of a circle of declination, and by taking the latitude and longitude of the star to that point of intersection, instead of employing a perpendicular to the ecliptick.

The only other passage, to which I shall draw the reader's attention, is one of considerable length, in which BRAHMEGUPTA, although he have rightly given the theory of Solar and Lunar Eclipses, with the astronomical principles on which they are to be computed, affirms, in compliance with the prejudices of *Hindu* bigots, the existence of *Ráhu* as an eighth planet, and as the immediate cause of eclipses, and reprehends VA'RA'HAMIHIRA, A'RYABHAT'T'A, SRI'SHE'N'A, and VISHN'UCHANDRA, for rejecting this orthodox explanation of the phænomenon. The passage is quoted by BHA'SCARA's commentator in the *Chintámani*, on the occasion of a more concise text of the *S'irómani*, affirming the agency of *Ráhu* in eclipses‡.

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* ब्रह्मगुप्तादिभिःस्वल्पान्तरत्वान्नकृतःस्फुटः॥ स्थित्यर्द्धपरिलेखादौगणितागतएवहि॥ नक्षत्राणां स्फुटाएवस्थिरत्वात्पठिताःशराः॥ दृक्कर्मणायने नैषांसंस्कृताश्चतथाध्रुवाः॥ &c. *Góládhyáya*, c. 8, v. 11, &c.

† As. Res. vol. 9.

‡ Part. 2, ch. 7, v. 10.

This quotation from the *Brahme-sidd'hánta* comprising seven couplets in the *Chintáman'i*, has been verified in the text of the *Brahme-sphu'ta-sidd'hánta* of BRAHMEGUPTA*.

All these, with numerous other instances in the annotations and commentaries of the *Sirómani*, which I refrain from adducing, lest the reader's patience should be tired, have established to my entire conviction the genuineness of the text of the *Sphut'a-sidd'hánta*, founded on a prior treatise entitled *Bráhme-sidd'hánta*.

I am not unapprised, that, under a feeling of great distrust or unwillingness to admit the conclusions which follow from this position, a variety of hypotheses might be formed to a different effect. BRAHMEGUPTA, supposing him to be entirely an original writer, may have referred to an imaginary work, to give that kind of authority to his performance which the *Hindus* most fancy; or he may have fathered on a *purán'a* a synopsis of his own doctrine for the same purpose: or some other writer, from whatever motive, may have fabricated a pretended extract of a *purán'a* containing the heads of BRAHMEGUPTA'S system, and have given currency to it on the strength of the reference in that astronomer's treatise to an anterior work. These and other suppositions grounded on surmise of fraud and forgery may be formed. I shall not discuss them; for I have no concern but with the facts themselves. BHA'SCARA, writing 650 years ago, declares, and so do all his commentators, that he has followed BRAHMEGUPTA as his guide. They quote numerous passages from his work; and BHA'SCARA affirms that BRAHMEGUPTA took the numbers of revolutions assigned to the planets in the great period termed *Calpa* from an earlier authority. The commentators, who wrote from two to four centuries ago, assert that

* *Góládhyáya.*

those numbers were taken from a treatise in form of dialogue between BHA'GAVAT (or BRA'HMA) and BHRIGU, inserted in the *Vishn'u-d'hermóttara-purána*, and distinguished by the title of *Bráhma* or *Pait'amaha Sidd'hánta*. They cite parallel passages, which do in fact exactly accord in sense and import. They occasionally quote observations on BRAHMEGUPTA by his scholiast CHATURVE'DA PRI̊THU'DACA SWA'MI'. A book is extant (a copy, partly deficient however, having come into my possession with other astronomical collections), and which consists of a text under the title of *Brahme-sphuta-sidd'hánta*, accompanied by a continual commentary by CHATURVE'DA PRI̊THU'DACA SWA'MÍ. The text contains the same astronomical doctrine which BHA'SCARA teaches, and which he professes to have derived from BRAHMEGUPTA; and passages quoted by him in his text, or at more length in his notes, or by his commentators, or by other astronomical writers, as the words of BRAHMEGUPTA, are found verbatim in it. I consider it therefore as the genuine text of the treatise used by BHA'SCARA as BRAHMEGUPTA's; and, seeing no reason for suspicion and distrust, I quote it as the authentick work of that celebrated astronomer.

As the evidence which has been here collected, with reference to particular points, bears also upon other questions, I shall now state further conclusions regarding the history of Indian astronomy, which appear to me to be justly deducible from the premises. Those conclusions will be supported, when necessary, by additional references to authorities.

BRAHMEGUPTA and VA'RA'HAMIHIRA, though named at the head of astronomers by BHA'SCARA and SATA'NANDA, and by the herd of later writers, are not to be considered as the authors of the *Indian* system of astronomy. They abound in quotations from more ancient astronomers, upon whose works their own are

confessedly grounded. In addition to the names beforementioned*, those of PRADYUMNA, LA'LA SINHA, and LA'D'HA'CHA'RYA, may be here specified. But the *Bra'hme-sidd'hánta* and the works of A'RYABHAT'T'A are what principally engage BRAHMEGUPTA's attention: and the five *Sidd'hántas* have been the particular subject of VARA'HA'MIHIRA's labours. He appears to have been anterior to BRAHMEGUPTA, being actually cited by him among other writers, whose errors are exposed and corrected.

VA'RA'HAMIHIRA, constantly quoted as the author of the *Váráhi-sanhitá* and *Pancha-sidd'hánticá*, must be judged from those works, which are undoubtedly his by the unanimous consent of the learned, and by the testimony of the ancient scholiast BHAT'T'O'TPALA. The minor works, ascribed to the same author, may have been composed in later times, and the name of a celebrated author have been affixed to them, according to a practice which is but too common in *India*, as in many other countries. The *Ját'acárn'ava* for example, which has been attributed to him, may not improbably be the work of a different author. At least I am not apprized of any collateral evidence (such as quotations from it in books of some antiquity) to support its genuineness as a work of VA'RA'HAMIHIRA's.

In the *Váráhi-sanhitá* this author has not followed the system which is taught in the *Súrya-sidd'hánta*. For instance, his rule for finding the year of the cycle of 60 years, founded on the mean motions of Jupiter, shews that he employed a different number from that which the *Súrya-sidd'hánta* furnishes: viz. 364224 revolutions in a *yuga*, instead of 364200; and it appears, from a quotation of the scholiast, that A'RYABHAT'T'A is the authority for that number of revolutions of Jupiter.

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* Page 223.

Before the age of VA'RA'HAMIHIRA and BRAHMEGUPTA, and subsequently to that of GARGA, a number of illustrious astronomers flourished, by whom the science was cultivated and promoted, but whose works unhappily are lost, or at least have not been yet recovered, and are at present known to us only by quotation. No less than ten intermediate writers are cited by BRAHMEGUPTA; of whom five at the least are noticed by VA'RA'HAMIHIRA*.

The proficiency of the *Yavanas* in astronomy was known to VA'RA'HAMIHIRA. He has mentioned it with applause †, and has more than once referred to the authority of their writers. The name of YAVANA'CHA'RYA, which occurs frequently in the compilations of *Hindu* astronomers ‡, has apparently reference to an author of that nation; which is characterised by VARA'HAMIHIRA as a people of *Mléch'has*, or barbarians. The title of *Rómaca Sidd'hánta* given by S'RÍSHE'NA to his astronomical treatise, which is quoted under this title by VARA'HAMIHIRA and BRAHMEGUPTA, may be presumed also to carry some allusion to the system of the astronomers of the West.

If these circumstances, joined to a resemblance hardly to be supposed casual, which the *Hindu* astronomy, with its apparatus of eccentricks and epicycles bears in many

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* See, before, p. 223, 225, and 246.

† म्लेच्छाहियवनास्तेषुसम्यच्छास्त्रमिदंस्थितं ॥
ऋषिवत्तेपिपूज्यंतेकिंपुनर्दैवविद्द्विजः ॥

"For the YAVANAS are barbarians; but this science is well established among them; and they are revered like holy sages: much more shall a priest who is learned in it be venerated."

‡ As. Res. vol. 9, p. 376.

respects to that of the *Greeks*, be thought to authorize a belief that the *Hindus* received from the *Greeks* that knowledge which enabled them to correct and improve their own imperfect astronomy, I shall not be inclined to dissent from the opinion. There does indeed appear ground for more than a conjecture that the *Hindus* had obtained a knowledge of *Grecian* astronomy before the *Arabs* began to cultivate the science; and that the whole cluster of astronomers mentioned by BRAHMEGUPTA, must be placed in the interval between the age of HIPPARCHUS, and possibly that of PTOLEMY, and the date of BRAHMEGUPTA's revision of the *Brahme-sidd'hánta*.

In reforming the *Indian* astronomy, BRAHMEGUPTA, and the astronomers who preceded him, did not take implicitly the mean motions of the Planets given by the *Grecian* Astronomer. In general they are wider from the truth than PTOLEMY*. But, in the instance which is the subject of this paper, they made a nearer approach to accuracy than he had done, and must there-

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* Mean Diurnal Motions of the Planets.

	Brahmegupta.					*Su'rya-sidd'ha'nta.*					*Ptolemy.*					*Lalande.*				
	°	I	II	III	IV	°	I	II	III	IV	°	I	II	III	IV	°	I	II	III	IV
☉	0	59	8	10	22	0	59	8	10	10	0	59	8	17	13	0	59	8	19	48
☽	13	10	34	52	47	13	10	34	52	3	13	10	34	58	30	13	10	35	1	40
☽-☉	12	11	26	42	25	12	11	26	41	53	12	11	26	31	17	12	11	26	41	52
♂	0	31	26	28	7	0	31	26	28	11	0	31	26	36	53	0	31	26	39	28
☿	4	5	32	18	28	4	5	32	20	42	4	5	32	24	12	4	5	32	34	13
♃	0	4	59	9	9	0	4	59	8	48	0	4	59	14	26	0	4	59	15	53
♀	1	36	7	44	35	1	36	7	43	39	1	36	7	43	6	1	36	7	48	24
♄	0	2	0	22	52	0	2	0	22	53	0	2	0	33	31	0	2	0	35	38

In this comparative Table, computed to fourth minutes, it will be remarked, that the *Hindu* astronomers mostly agree to third minutes and differ in the fourths. They disagree with PTOLEMY at the thirds, and give, in almost every instance, slower motions than he does to the Planets, and still slower than the truth. In the moon's synodical motion, however, they are very nearly correct. On the other hand, the equation of the centre deducible from the epicycles (page 239) is

fore have used other observations besides those which he has recorded.

The *Arabs* adopted, in its totality, PTOLEMY's theory of the motions of the planets; which the *Hindus* have only in part. But the *Arabs* improved on his astronomy by careful observations; a praise to which the *Hindus* are not equally entitled. ALBA'TANÌ discovered the motion of the Sun's apogee, and suspected from analogy a motion of the apsides of the minor planets *. The *Hindus* surmised the motion of the apogee of the Sun, and nodes and apsides of the planets, from analogy to the Moon's †, but were unable to verify the conjecture by observation; and have in fact merely assigned arbitrary numbers to the supposed revolutions, to bring out the places right, (or as nearly so as they had determined them,) relatively to the origin of the ecliptick in their sphere, and conformably to their assumption of a grand conjunction of the planets, nodes, and apsides, in that point of the ecliptick at a vastly remote period. BHA'SCARA, when treating of the manner of verifying or of

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a nearer approximation to the truth than results from the eccentricity assigned by PTOLEMY to the Orbits of the Planets.

For instance:—

	°	′	″
Eccentricity of the Sun's Orbit:			
Súrya Sídd'hánta and *Brahmegupta* (Radius of the Epicycle)	2	10	30
Hipparchus and Ptolemy (Alm. l. 3. c. 4.) in parts, of which Radius contains 60	2	29	30
Albátanì (c. 28.)	2	4	45
Greatest equation of the sun's centre.			
Súrya-sidd'hánta, &c. (computed by the commentators)	2	10	32
Ptolemy (Ricc. Alm. nov.)	2	23	
Albátanì	1	59	
Alphonsine Tables	2	10	
Kepler, &c.	2	3	46
Lalande (3d Edit.)	1	55	36½

* Montucla, p. 349.

† BHA'SCARA in *Vásanábháshya*.

finding the number of revolutions of the planets, &c., in a given period, teaches the mode of observing the planetary motions, but considers the life of man too short for observing the motion of the apsides and nodes (the Moon's excepted): and certainly the revolutions assigned to them by him and other *Hindu* astronomers are too few, and the motion too slow (the quickest not exceeding 7 degrees in 100000 years), to have been assumed on any other ground but the arbitrary one just now stated. The astronomical instruments employed by the *Hindus*, of which BHA'SCARA describes nine, including one of his own invention, and comprehending the quadrant, semicircle, and entire circle, besides the armillary sphere, horary ring, gnomon, and clepsydra*, were too rudely executed, whatever may be thought of their design, to enable the astronomers to make very delicate observations; and they were not assisted, as in the precession of the equinoxes, by the memory of a former position recorded in their ancient writings.

NOTE REFERRED TO FROM PAGE 230.

According to A'RYABHA'T'T'A, as quoted by BRAHMEGUPTA and his scholiast PRĬT'HU'DACA SWA'MI',

One *Yuga* contains	Years	1,080,000
One *Mahá-yuga* =	4 *Yugas*	4,320,000
One *Menu-yuga* =	72 *Mahá-yugas*	311,040,000
One *Calpa* = 14 *Menus* =	1008 *Mahá-yugas*	4,354,560,000

☞ The *Calpa* began on Thursday 1st *Chaitra s'uela*, at the moment of sun-rise at *Lancá*.

Years expired from the commencement of the *Calpa* to the war of the *Bhárata*, or beginning of the *Cali age*,	1,986,120,000
Add expired years of the *Cali* to the *S'aca* era....	3,179
Years from the beginning of the *Calpa* to the commencement of the *S'aca* era....................	1,986,123,179

* Góládhyáya, ch. 9.

Years expired from the commencement of the present *Mahá-yuga* to the beginning of the *Cali age*, when there was a conjunction	3,240,000
Revolutions of the earth round its own axis, in a quadruple *yuga*, or *Mahá-yuga*..................	1,582,237,500
Hence, deducting revolutions of the sun	4,320,000
Remain, Nycthemera, or *Sávana* days, in a *Mahá-yuga*	1,577,917,500

☞ Length of the sidereal year is therefore, according to A'RYAB'HAT'T'A .... d 365 g 15 I 31 II 15 or d 365 h 6 I 12 II 30

N. B. A'RYAB'HAT'T'A taught the earth's diurnal revolution round its axis; a doctrine which BRAHMEGUPTA controverts, but to which his scholiast PRĬT'HU'DACA SWA'MI' inclines.

According to the *Paulis'a-sidd'hanta* cited by BHAT'T'ÓTPALA on VA'ṚA'HAMIHIRA's *Sanhitá*, and by PRĬT'HU'DACA SWA'MÍ on BRAHMEGUPTA's *Sidd'hánta*,

Crĭta-yuga,	4,800 divine years	=	1,728,000
Trétá,	3,600	=	1,296,000
Dwápara,	2,400	=	864,000
			3,888,000
Cali,	1,200	=	432,000
Mahá-yuga,		=	4,320,000

☞ This author's computation of the *Calpa* has not been found in any quotation; but he is cited as reckoning its commencement from midnight.

Years expired from the commencement of the present *Mahá-yuga* to the first conjunction of the planets, in the *Crĭta-yuga*..........................	648,000
Interval between that and the last conjunction, at the beginning of the *Cali-yuga*	3,240,000
Years expired to the commencement of the *Cali-yuga*,	3,888,000
Mean solar (*Saura*) days, termed by other astronomers *Sávana* days, in one *Mahá-yuga*	1,577,917,800

☞ Length of the year, according to the *Paulisa-fidd'hánta* .... d 365 g 15 I 31 II 30 or d 365 h 6 I 12 II 36

N. B. The difference of 300 days in the computations of ARYAB'HAT'T'A and PULIS'A, gives one day in 14,400 years, as is remarked by BRAHMEGUPTA.

	d	g	I	II	III		d	h	I	II	III	IIII
Length of the year, according to the *Súrya-sidd'hánta*	365	15	31	31	24	=	365	6	12	36	33	36
—— according to BRAHMEGUPTA	365	15	30	22	30	=	365	6	12	9		

The computation of the *Yuga* and *Calpa*, according to these authorities, is well known, and need not be exhibited in this place. They make it begin on Sunday; the one at midnight, the other at sunrise, on the meridian of *Lanca;* and the elapsed years to the beginning of the *Cali* age are 1,972,944,000. (To which BRAHMEGUPTA adds 3,179 years to the *S'aca* era.) The *Súrya-sidd'hánta* deducts 17,064,000 years; making the epoch of a supposed conjunction of planets by so many years later than the beginning of the *Calpa.*

REVOLUTIONS OF THE PLANETS.

	According to PULIS'A, quoted by BHAT'T'ÓTPALA, In a *Mahá-yuga.*	According to the *Súrya-sidd'hánta,* In a *Mahá-yuga.*	According to BRAHMEGUPTA, In a *Calpa.*
Sun	4,320,000	4,320,000	4,320,000,000
Moon (Periodical)	57,753,336	57,753,336	57,753,300,000
Mars	2,296,824	2,296,832	2,296,828,522
Mercury	17,937,000	17,937,060	17,936,998,984
Jupiter	364,220	364,220	364,226,455
Venus	7,022,388	7,022,376	7,022,389,492
Saturn	146,564	146,568	146,567,298
Days	1,577,917,800	1,577,917,828	1,577,916,450,000

☞ A'RYAB'HAT'T'A states the revolutions of Jupiter at 364,224. And VA'RA'HAMIHIRA's rule for the cycle of 60 years of Jupiter is founded on that number. The periods assigned by these two authors to other planets have not been ascertained; except Saturn's aphelion, reckoned by A'RYAB'HAT'T'A at 54 revolutions in a *Calpa.* A'RYAB'HAT'T'A's numbers are said to have been derived from the *Párásara-sidd'hánta.* (As. Res. vol. 2, p. 242.)

VII.

On the Height of the Himálaya Mountains.

BY H. T. COLEBROOKE, ESQ.

WHEN I presented to the Society the narrative of a journey, performed by Lieutenant WEBB and Captain RAPER, to explore the sources of the Ganges, I had occasion to notice the observations mentioned to have been made for determining geometrically the altitude of remarkable peaks of the snowy mountains, and the inference which appeared to be fairly deducible, that this chain of mountains is among the most elevated in the known world, neither surpassed nor rivalled by any other but the *Cordillera* of the *Andes* *. I should have been justified by the premises in saying more: but I thought it right to speak thus guardedly; not having been then enabled to examine the particulars of the altitudes taken, the distances measured, and the calculations founded on them; nor to procure barometrical measurements tending to confirm or to correct conclusions drawn from those grounds. But having been since furnished with further observations taken by Lieutenant WEBB, in prosecution of the same inquiry, and having compared them as well with those before made by him, and by the late Lieutenant-Colonel COLEBROOKE, as with Lieutenant-Colonel CRAWFORD's labours in the pursuit of the same

* As Res. vol. xi, p. 445.

inquiry, I consider the evidence to be now sufficient to authorize an unreserved declaration of the opinion, that the *Himálaya* is the loftiest range of Alpine mountains which has been yet noticed, its most elevated peaks greatly exceeding the highest of the *Andes*.

This had been long suspected, or rather had been very generally believed, in *India*, upon less conclusive evidence than will now be submitted to the public. It was remarked, that this chain of mountains constantly covered with snow is visible from the plains of *Bengal* at the distance of 150 miles * (it might have been said at a still greater distance). This fact demonstrates great elevation. For the peak of *Teyde*, or *Teneriffe*, measuring nearly 12,000 feet †, is discernible in clear weather at a distance of 120 miles, and appears like blue vapour scarcely darker than the sky; and *Chimborazo*, the highest peak of the *Andes*, ascertained to be more than 20,000 feet high ‡, is seen at a distance of little more than 60 leagues, the rest of the *Cordillera* of the *Andes* being then concealed from view: but the *Himálaya* chain of mountains is visible in the horizon, as a continued line extending through more than two points of the compass, at a distance equal to that last mentioned, appearing in clear weather like white cliffs, with a very distinctly defined outline.

To justify the assertion, that the distance, at which the chain of snowy mountains continues to be visible, exceeds 150 miles, it may be sufficient to mention, that it is seen bearing Easterly of North, from *Patna* and from other stations (as *Bhágalpúr*, &c.), on the Southern bank of the Ganges. Now the latitude of *Patna*, by astronomical observation, is 25° 36′ §; and that of *Cat'h-*

* RENNEL's Memoir of a Map, p. 302. (2d Edit.)
† 1,904 *French* toises.
‡ 3,220 *French* toises.
§ REUBEN BURROW.

mandú, nearly due North of it, is 27° 42′ *, the difference being 126 geographic, or about 146 English, miles. But the nearest of the *Himálaya* mountains are yet distant in a horizontal line above 25 miles from the last-mentioned town; more than one valley and intermediate ridge being interposed; some of which, to a distance of ten miles, have been visited by *Europeans*, without approaching within several days' travelling distance of the foot of the *Himálaya* †.

The continuation of the same chain of mountains divides *Bután* from *Tibet*, and is distinctly visible from the plains of *Bengal*. Captain TURNER and Mr. SAUNDERS, on their journey to *Tisholumbo*, after traversing *Bután* and crossing the frontier of *Tibet*, found themselves near a range of mountains covered with everlasting snow, which seemed to be but two miles distant from their route. Captain T. particularly noticed a conspicuous peak held in high veneration by the *Hindus*, and named *Chamalári*. Both the travellers were satisfied, the one from the remarkable form of the peak, the other from the height and bearings of the range, that the mountains which they then viewed are the same which are seen from *Purnea*, *Rajmahl*, and other places in *Bengal* ‡. Now, according to the survey of Captain Turner's route, *Chamalári* is placed in Lat. 28° 5′ Long. 89° 18′; a position no less than 165 geographic miles from *Purnea*, and 200 from *Rajmahl*, which is situated in Lat. 25° 3′ and Long. 87° 44′ by observation §. From a commanding eminence, on the frontier of *Tibet*, the travellers had an extensive view of the mountains of *Bután*, covered with verdure to the very tops; and it appears, from what is said by them, that *Bután* contains no mountains on which snow con-

* Lt.-Col. CRAWFORD.

† General KIRKPATRICK's Account of the Kingdom of *Nepal*.

‡ Capt. TURNER's Narrative, p. 203 (2d Edit.), Phil.-Trans. vol. 79.

§ REUBEN BURROW.

tinues during all seasons of the year, and few on which it remains until the middle of summer. These circumstances seem to establish, beyond question, the fact, that the snowy range, of which *Chamalári* is a part, is that which is seen from stations in *Bengal*, distant 165 and even 200 geographic miles, answering to 191 and 232 *British* miles. Now it requires an elevation exceeding 28,000 feet to be barely discernible in the mean state of the atmosphere at so great a distance as that last mentioned; though a much less elevation, it must be acknowledged, may suffice under circumstances of extraordinary refraction.

The presumption, which was however raised on these grounds, was to my apprehension corroborated by observations, which I had myself the opportunity of making twenty years ago; and which gave, according to the note I have preserved of them, 1° 1′ for the usual altitude of a conspicuous peak of the *Himálaya* viewed from a station in *Bengal*, which, according to the construction of RENNEL's map, was not less distant than 150 English, or about 130 geographic, miles. If this distance might be relied on, the height to be inferred from that observation of altitude, after a due allowance for terrestrial refraction, would considerably exceed that of *Chimborazo*, being not less than 26,000 feet above the level of the plains of North *Bengal*. But, as the distance was not ascertained with sufficient accuracy for the purpose of confidently grounding on it a calculation of this nicety, I proposed to determine it by observations of the bearings of the same peak, from two places distant enough to afford an adequate base, the length of which might be found by correct survey. Not having had the means of completing the inquiry upon the principle here explained, I recommended it to the attention of the late Lieutenant-Colonel COLEBROOKE, by whom it was prosecuted during his survey of *Rohilkhand;* and it has been further pursued to a satisfactory result by his assistant, Lieutenant

WEBB, during his journey towards the sources of the Ganges, and finally during a survey of the province of *Górakhpúr*.

Colonel COLEBROOKE's notice was also drawn to the subject by the communications of Dr. FRANCIS BUCHANAN and Lieutenant-Colonel CRAWFORD, who both visited *Nepal* in 1802, and who were convinced by the information they received there, from intelligent persons, that the sources of the Ganges are on the southern face of the *Himálaya*, and that these mountains are of vast height. He had likewise a knowledge of a survey by Lieutenant-Colonel CRAWFORD, executed in 1805, along the northern frontier from *Behar* to *Róhilkhand*, in which bearings were taken of every remarkable peak of the snowy range, which could be seen from more than one station; and consequently the distance of those peaks from the places of observation, and their geographical positions relatively to the plains of *Hindustán*, were determined by the intersection of the bearings and by calculation. Colonel CRAWFORD had also taken altitudes, from which the height of the mountains might be computed, and which gave, after due allowance for refraction, the elevation of conspicuous peaks, at least equal to that above mentioned. But the drawings and journal of this survey have been unfortunately lost.

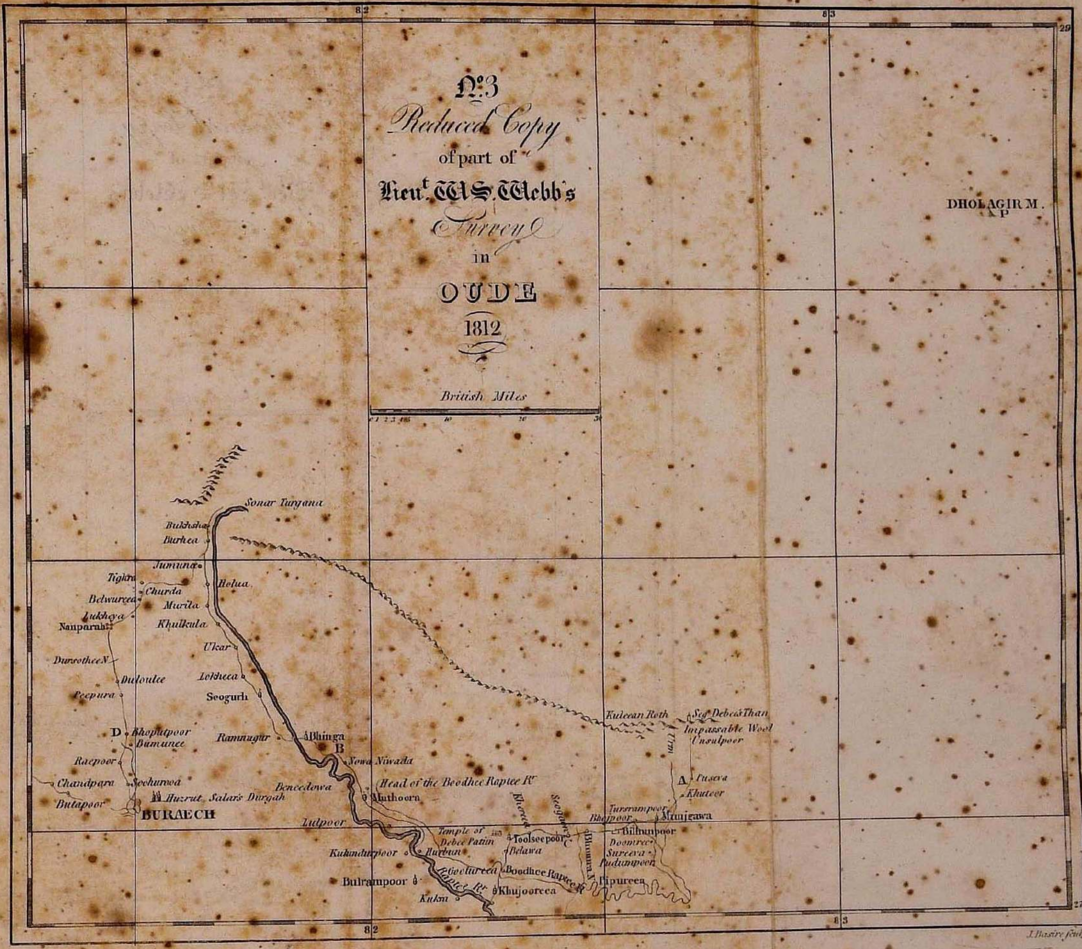
The observations instituted and completed by Lieutenant-Colonel COLEBROOKE, while in *Róhilkhand*, were two; one taken at *Pilibhît*, where the elevation of a peak distant 114 English miles, according to bearings from two stations, the distance between which was measured, was found to be 1° 27′; the other at *Jét'hpúr*, where the elevation of the same peak, distant 90 English miles, was observed to be 2° 8′. I find among his papers numerous other observations of the bearings and appearance of the chain of snowy mountains, as seen from

many successive stations. But the only altitudes which have been preserved are those above mentioned.

In calculating from these observations of altitude, allowance was first made for refraction at the same rate as for celestial objects of the same apparent altitude: and, from the observed elevation so corrected, was deduced a height of 20,019 feet for the mountain as viewed from *Pilibhít*, and 20,598 for the same as seen from *Jét'hpúr*, or 20,308½ feet on a medium of both observations. But the allowance for refraction being much too great, amounting to $\frac{2}{9}$ths of the contained arc in one instance and $\frac{3}{13}$ths in the other, the computation was again made, allowing $\frac{1}{8}$th of the intercepted arc for terrestial refraction, and the result showed a height approaching to 22,000 feet above the level of the plains of *Róhilkhand*.

However, this allowance of an eighth part of the contained arc still exceeds the mean of terrestrial refraction, as appears from the trials conducted by General Roy, and Colonels Williams and Mudge*, and especially from those of the last-mentioned observer. They found terrestrial refraction subject to great variation, amounting to no less than $\frac{1}{3}$d of the contained arc in some instances, and so small as $\frac{1}{35}$th of the intercepted arc, and even less, or absolutely 0, in others. But, in the numerous observations of those gentlemen, the extreme instances are few; and the range of variableness is commonly within narrower limits, from $\frac{1}{7}$th to $\frac{1}{18}$th, being on a mean either $\frac{1}{11}$th or $\frac{1}{12}$th part. The trials most to be depended on, being those which were conducted by means of correspondent and contemporary observations, give a mean of $\frac{1}{11}$th. It appears, also, that the refraction is least variable where the ray passes through the air at a considerable distance from the surface of the earth, for the greatest part of its course: which is eminently the

* Phil. Trans. vol. 80, 85, and 87.



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case in the instance under consideration; and especially in some which will be subsequently noticed, where the altitude of the mountains was taken from elevated spots: and, in all, the ray must pass for a great part of its course through a stratum of the atmosphere of much less density than in the experiments of General ROY and Colonel MUDGE, to which reference has been made.

It follows, from these considerations, that the mean terrestrial refraction should not be taken at more than $\frac{1}{11}$th of the arc contained between the object and station. This allowance agrees with that which DELAMBRE directs to be made: it exceeds what was found by LEGENDRE, (viz. $\frac{1}{14}$th); and it approaches very near to MASKELYNE's estimate of $\frac{1}{10}$th. But from Major LAMBTON's observations, in the peninsula of *India*, terrestrial refraction was found to vary from $\frac{1}{4}$th to $\frac{1}{18}$th*, or on a medium $\frac{1}{8}$th of the contained arc. As this mean refraction may be thought more applicable to the north of *India* than that deduced from the trials made in the climate of *Great Britain*, I shall compute from altitudes reduced by this as well as the preceding correction for refraction, and contrast the results with similar calculations, in which the refraction shall be taken at the utmost quantity which any past experience could justify, viz. $\frac{1}{3}$d of the arc.

To compute from the data, we have, in an oblique plane triangle, the angle (B) at the base of the mountain, which exceeds a right angle by half the contained arc; or (which is the same thing) by half the angle at the earth's centre subtended by that arc; the angle (S) at the station of observation, which is the sum of the observed altitude (corrected for refraction) and half the contained arc; and one side (A), which is the chord of the contained arc, or distance between the

* Page 100 of this Volume.

base of the mountain and station of observation, differing but a few feet, in the cases before us, from the circular arc itself. The angles and one side of the triangle being thus known, the other two sides may be found; one of which, subtending the angle S, is the height of the mountain, or perpendicular from its summit to the middle of its base. The observations at *Pilibhít* and *Jét'hpúr*, calculated upon this principle, and with an allowance of $\frac{1}{11}$th for refraction, give 22436 and 22146 for the elevation of the peak observed from those stations; or on a mean 22291 feet above the level of the plains of *Rohilkhand;* or about 22800 feet above the level of the sea.

In the same manner may be calculated the height of the peak, situated, according to the information of the mountaineers, near the source of the *Jamuná*, and measured from the summit of *Nágún-ghâtí*, near *Lálúrí*, under an angle of 3° 17′, and, from that of *Chandra-badaní*, under one of 2° 50′. The position of the mountain, deduced from horizontal angles taken at both stations, is settled by Mr. Webb in lat. 31° 23′, long. 78° 31′*. The latitude of the stations, determined by astronomical observations made at the next places of encampment †, is 30° 32′ and 30° 20′; and the distances, taking the longitudes as inferred from survey, are 54′.2 and 63′.2 geographic miles respectively. Whence, allowing $\frac{1}{11}$th for refraction, we have 20895 and 21855 feet; or, with an allowance of $\frac{1}{6}$, 20503 and 21320 feet; for the elevation of the mountain above those stations. Their respective heights are yet unascertained: but *Chandra-badaní* was, by Mr. Webb, thought the highest, contrary however to what the result of the present calculation indicates. The height of *Nágún-ghâtí* was estimated by him at 5000 feet; and this guess is

* *Asiatick* Researches, vol. 11, p. 442.
† MS. Journal.

corroborated by a trigonometrical measurement of a mountain called the *Khanjar* near *Bhuwan-dévi* *, seen the preceding day, and found to be 3297 feet above the valley. It is distantly supported by barometrical measures of mountains in a different part of the same chain, as will be noticed further on.

The elevation of the *Jamunávatári* appears then to be not less than 25000 feet above the valley. It is however right to observe, that this measurement of the height of that mountain above the summit of the passes from which the angles were observed is not entirely to be relied on; as the distances are not determined with sufficient precision, being dependent on the relative position of the stations in longitude, concluded from a survey performed by means of a route measured by time in a very uneven country.

It might be expected that use should be made of numerous other observations, which were taken from various elevated situations among the lower mountains, especially those which exhibited much larger angles; on the presumable ground, that the height of any selected point among the numberless snowy peaks of the *Himálaya* would be best ascertained by angles taken at the nearest positions approaching it. No doubt such would be the case, could a survey be leisurely performed in the mountains, choosing the fittest stations upon a previous view of the country, and satisfactorily identifying the point to be observed. But a hasty journey (more was not in this instance practicable) among mountains nearer to the object affords less means of an accurate measurement than a survey carefully conducted at a remoter distance in the champaign country. Instead of keeping in view, from day to day, during the progress of survey, the same se-

* It is to be regretted that more frequent opportunities did not occur for similar measurements.

lected point, and being fully assured of its identity by the uniformity, or at least the very gradual alteration of its appearance, the traveller through the mountainous skirts of the *Indian* Alps loses sight of those objects for successive days as he proceeds along the valleys, and finds it impracticable, when he emerges to higher ground, his route leading him over some mountain, to discern from its summit the loftiest peak, now perhaps intercepted from his view by one nearer, though of less elevation; or to discriminate and recognise among innumerable glaciers, which have varied their aspect with his change of place, the particular snowy peak before contemplated by him from another side, in a different point of view, and with another aspect.

On these considerations, and after carefully inspecting Mr. WEBB's journal, in which I find observations of unnamed snowy peaks seen from the stations of *Rét'hal** and *Bahmencót'hí* † under angles of nine and ten degrees; with others, from more distant stations, of mountains supposed to be known, as the peak near *Gangávatárí* seen from *Nágún-ghátí* and *Chandra-badaní* ‡, and *Cédár-nát'h* from the last mentioned station §; I do not deem any of these points to be so verified as to be made the certain grounds of a correct measurement of altitude. The horizontal distance of the near glaciers appeared to the travellers, in more than one instance, to be only ten miles ‖; but this, being a mere guess, cannot serve for the basis of correct calculation. Employed as a conjectural measure, it gives 9000 feet for the height of the objects above the lofty spot whence they were viewed.

* 10° 18′. 9° 55′. 9° 42′. 9° 19′. 8° 19′ bearing respectively N. 62° 49′. E. N. 59° 04′ E. N. 54° 56′ E. N. 49° 42′. N. 45° 28′ E. and further diminishing as the bearings grew more Northerly.

† 9° 55′. 9° 14′. 8° 17′ bearing N. 43° 35′ E. N. 39° 12′ E. N. 28° 17′ E. respectively.

‡ 3° 1′ and 2° 50′.

§ 2° 34′.

‖ *Asiatick* Researches, 11, p. 515 and 552.

The position of *Cédár-nát'h* is not confidently stated *, the materials for determining it being insufficient. Supposing however that of *Gangávatári* to be more nearly correct, the pyramidical peak in the vicinity of that celebrated place, if indeed the same which was seen and measured from *Nágún-gháti*, is 17784 feet above the summit of that pass, esteemed to be 5000 feet high.

But, leaving these conjectures and doubts, let us pass to more certain observations and more exact measurements. To Colonel CRAWFORD I am indebted for the communication of observations made by him at *Cat'hmándu.* Another set, much more numerous, was taken by him during an extensive survey along the frontier, but it is not at present within his reach. If not actually lost, as was believed when a preceding paragraph of this essay was written, the journal of his observations is probably in *England*, and, when there found, will confirm what is here stated upon other grounds.

At present what we possess of that laborious survey is the protraction of it, showing the positions of the mountains as they were determined by cross bearings taken from a great number of stations between *Púrnea* in *Bengal,* and *Balrámpúr* in *Ayudh.* This document, however, is invaluable for the purpose of the present inquiry.

Colonel CRAWFORD, during a long sojourn at *Cat'hmándú* in 1802, took the angles of several selected points, of which he determined the distances by trigonometrical measurement, having taken the bearings from various stations in the valley of *Népál*, the relative situations of which were ascertained by a trigonometrical survey proceeding from a base of $852\frac{3}{4}$ feet, carefully measured four times, and verified by another base of 1582 feet,

* *Asiatick* Researches, 11, p. 442.

measured twice. The positions of the same mountains were also settled by observations of them made from the plains of *Behar* in the progress of the great survey which has been mentioned.

The angles of elevation of the mountains above the stations of *Sambhú* and the queen's garden near *Cat'hmándu* were taken with an astronomical sextant and an artificial horizon, Among the most remarkable is an observation of a mountain pointed out as mount *Dhaibun*. It was seen under an angle of 5° 4′ 21″, and ascertained to be distant $35\frac{2}{7}$ g. m. The elevation calculated from this measure is 20140 feet above the station from which the altitude was taken, and which is itself more than 4500 feet above the level of the sea, as concluded from barometrical observations to be subsequently mentioned. Another seen under a similar angle, 5° 3′ 58″, but less distant by four miles, exceeds the elevation of the station by 17819 feet. Both these mountains are but little to the eastward of north from *Cat'hmándu*. The following are as little north of east; viz. one nearly in the position of the *Cála-bhairava**, distant 59 g. m., with an altitude of 2° 48′ 6″, and consequently 20025 feet high; another in its vicinity, with an angle of 3° 23′ 6″, distant 48 g. m. and elevated 18452 feet; and a third, as much more remote, being 68 g. m. with an altitude of 2° 7′ 21″, and a consequent elevation of 18662 feet above *Cat'hmándu*.

All those mountains are perceivable from *Patna*: the first or the supposed *Dhaibún*, at a distance of 162 g. m., and *Cála-bhairava*, or the mountains in its vicinity, at that of 153, 150, and 145 g. m. These are the nearest of the *Himálaya* which are visible from that city. The most remote are seen in the N. E. quarter, at the prodi-

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* General KIRKPATRICK's Account of *Nepál*.

gious distance of 195 g. m., ascertained by their position, which is determined by bearings taken by Colonel CRAWFORD from stations approaching within a hundred miles of their site.

Mount *Dhaibún*, or at least the peak which was indicated to Colonel CRAWFORD under that name, and which is not surpassed by any of the points measured from *Cat'hmándu*, was viewed by General KIRKPATRICK, if indeed it be the same mountain, from a position ten miles nearer to it on mount *Bhirbandi* *, and his animated description of the sublime prospect contains presumptive evidence that the remoter glaciers of the *Himálaya* are still more elevated; for he speaks of a neighbouring mountain not less stupendous, yet surpassed by one of the pyramidical peaks of the snowy chain seen peeping over its towering summit. It may readily be credited that the more accessible mountains which approach *Cat'hmándu*, as *Jibjibia*, *Dhaibún*, and *Dhúnchá*, may be inferior in height to the abrupter peaks in the chain of the *Himálaya*.

Among the loftiest in that chain is one distinguished by the name of *Dhawala-giri*, or the white mountain, situated, as is understood †, near the source of the *Gandhac* river, called in its early course *Sálagrámí*, from the schistous stones, containing remains or traces of ammonites, found there in the bed of the river, and thence carried to all parts of India, where they are worshipped under the name of *Sálagráma*; the spiral retreats of

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* Account of *Nepál*, p. 138. It is right to observe that the map annexed to that publication places *Dhaibún* and other mountains, as *Dhúncha* and *Ghirkhú*, much nearer to *Cat'hmándu* than they are by Colonel CRAWFORD's survey. The latter is however most to be depended on.

† KIRKPATRICK: *Nepál*. *Sálagráma* stones are found in great abundance near *Muctinát'h*, and more sparingly at *Dúm dher cúnd* still nearer to the source of the *Gandhac*. Colonel CRAWFORD's MS.

antediluvian molluscas being taken by the superstitious *Hindu* for visible traces of VISHNU.

A high peak, among the most conspicuous of those which are seen from the plains of *Górakhpúr*, and on that account selected by Mr. WEBB for a measurement, conducted by means of observations taken at different stations in that province, was pointed out to him as recognised by the mountaineers to be *Dholagir* (*Dhawalagiri*). Mr. WEBB took the bearings from four stations, and altitudes from three; and the particulars of his observations are as follow:—

At station A, situated near *Khatúr*, bearing of the snowy peak P, corrected for magnetic variation and error of adjustment by an azimuth observed at the time	N. 30° 12′ E.
Altitude	2° 48′
At station B, *Nowá newádá* on the *Rapti*. Bearing of P	N. 49° 30′ E.
At station C, two furlongs W. of *Séúgaon*. Bearing of P	N. 35° 49′ E.
Altitude	2° 19′
At station D, two furlongs W. of *Bhópetpúr*. Bearing of P, ...	N. 60° 1′ E.
Altitude	1° 22′
B bears from A by the survey, W. 2° 5′ N. distant, ...	43,4 B. M.
D bears from A, W. 7° 5′ N.	73,5 B. M.
The bearing of C from A is not used, the side A C measuring only 16,3 B. M.	
C to B W. 13° 54′ N. distant	29,4 B. M.
C to D W. 15° N.	60 B. M.
B to D W. 14° 3° N.	30,5 B. M.

From these data Mr. WEBB computes the distance of

the peak (P) from the stations A, C and D*, at the numbers under mentioned: viz. From the station A, by the triangle A P B, 89,6, and by the triangle A P D 89,1; mean of both computations 89,35 miles, or 471768 feet. From the station D, by the last triangle, 135,9, and by C P D 136,8; mean of both, 136,35 miles, or 719928 feet. From C, by the last of these triangles, 103,4, and by C P B 102,3; mean of both 102,85 miles, or 543048 feet. He remarks that several other bearings of the same peak were taken from different stations; and that, by laying off the rhumb-lines of bearing on the map, they intersect at very inconsiderable distances from the position of the peak, as deduced from those which were selected for calculation.

Let us proceed to compute the height of *Dhawalagiri* (vulg. *Dhólágir*) with the foregoing measures of distance and the observed altitudes.

At the station A we have the distance 471768 feet, 77,85 geographic miles†, or in parts of a circle 1° 17′ 51″; the chord of which in feet is 471758. The altitude observed being 2° 48′, and the refraction being taken at $\frac{1}{12}$th of the intercepted arc, the angles are S 3° 20′ 26″ 15‴ and P 86° 0′ 38″ 15‴, with the side S B 471758; whence we have the side B P, or height of the mountain, 27558 feet.

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* See the annexed map.

† The geographic mile, or sixtieth part of a degree of a great circle, is here taken at 6060 feet. The length of the meridional degree in different latitudes, according to the latest measurements, being 60995 fathoms in latitude 66° 20′, 60820 in latitude 52° 2′, 60783 in latitude 46° 12′, and 60487 in latitude 11° 6′; whence may be concluded 60600 nearly between the latitudes 27° and 31°; and this measure is employed without correction or modification, though the position of the arcs be at acute angles to the line of the meridian; greater precision in reducing the distances to parts of a great circle appearing to be unnecessary, as the utmost accuracy would make little difference in the computed height of a mountain.

By a similar calculation of the altitude of the same mountain observed from the stations C and D; viz. 2° 19′ and 1° 22′, or corrected for refraction 2° 11′ 32″ and 1° 12′ 6″, with the distances above found, which in parts of a circle are 1° 29′ 36″ 36‴ and 1° 58′ 48″, and, reduced to the chords of the arcs in feet, 543031 and 719893, the height comes out 27900 and 27573; or, on a mean of the three, 27677 feet above the plains of *Gorak'hpúr*; and reckoning these to be 400 feet above the mouth of the *Ganges*, as inferrible from the descent of the stream of rivers, the whole height is more than twenty-eight thousand feet above the level of the sea.

The following table exhibits a comparison of this result, with other computations made on different rates of refraction:—

Station.	Distance in miles.	Interc. arc in deg.	Alt. by obs.	Height, allowing for refraction. $\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{11}$	$\frac{1}{12}$	$\frac{1}{13}$	$\frac{1}{18}$
A	$89\frac{15}{100}$	1° 17′ 51″	2° 48′	24875	26663	27110	27476	27558	27626	27855
C	$102\frac{85}{100}$	1° 29′ 36″.6	2° 19′	24348	26716	27308	27792	27900	27991	28294
D	$136\frac{35}{100}$	1° 58′ 48″	1° 22′	21338	25494	26554	27384	27573	27773	28286
			Mean	23520	26091	26784	27551	27677	27797	28145
			Extreme difference	3537	1222	774	408	342	365	439

It is apparent, from inspection, that the observations at the stations A and D agree best; and if that computation be nearest the truth, wherein the extreme differences are least, the conclusion will be, that the height is about 27550 feet; such being the elevation deduced from the mean of observations calculated according to middle refraction.

The limit of error arising from refraction must be taken at less than 850 feet, as the observations at A and C coincide for the height of 26690 feet, $\frac{1}{6}$th of the contained arc being allowed for refraction; and those at C and D for an elevation of 28290 feet, $\frac{1}{18}$th being allowed; while those at A and D do so for the mean altitude of 27565

feet, refraction being taken at the middle rate of $\frac{1}{12}$th; and a larger allowance than $\frac{1}{6}$ th of the intercepted arc, which would exceed mean celestial refraction for like altitudes, cannot be requisite, without very wide disagreement in observations made on different days, which would mark extraordinary refraction; but that is not the case with those in question.

The limits of error in respect of the observations themselves, whether for the distance or for the altitude, are more confined, since the uncertainty in the distance, amounting to a quarter of a mile in one instance, and half a mile in the rest, induces uncertainty in the computed elevation to no greater extent than 76 or 99 feet for the nearer stations, and 180 for the most remote. An error of a whole minute in an observation of altitude affects the consequent calculation of height in the proportion of about 200 feet for the more distant station, and 130 to 150 for the nearer. But the instrument which was used should, with due care, give angles true within that quantity; and the observer was enjoined to take the angles to the nearest minute*.

It would be an extreme supposition that the errors have in every instance been the highest possible, and on the side of excess. Assuming, however, that they are so, the elevation, as observed from the two nearest stations, is not reduced below 26457 and 26467, or, on the mean of both, 26462 above the plains of *Górak'hpúr*.

We may safely then pronounce that the elevation of *Dhawalagiri*, the white mountain of the *Indian* Alps †,

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* Instructions, quoted in *Asiatick* Researches, vol. 11, p. 448. The writer of these was acquainted with the instrument, and knew the degree of precision which it comports.

† *Sans. Dhawala*, white; *Giri*, mountain. Vulg. *Dhoulagir*, the white mountain. KIRKPATRICK'S *Nepal*, p. 287. It is the *Mont-blanc* of the *Himálaya*.

exceeds 26862 feet above the level of the sea; and this determination of its height, taken on the lowest computation of a geometrical measurement, is powerfully corroborated by the measure of an inferior, though yet very lofty mountain, observed from stations in *Rohilkhand*.

It may be satisfactory to bring this measurement to the test of comparison with the calculation of heights from like observations of small angles at great distances in a case where the elevation is otherwise known or more precisely determined. This we are enabled to do in the very instance most to be desired, that of *Mont-blanc*, heretofore considered to be the loftiest mountain of the old continent. Its altitude, as seen from *Pregny*, a station half a league from *Geneva*, near the lake, exhibits an angle of 3° 14′, according to an observation by De Luc *. The distance is stated by him in round numbers, 227000 *French* feet; but appears from Sir G. Shuckburgh's series of triangles † to be over-rated, the distance of *Geneva*, a little more remote, being no more than 225098 *English* feet. Calculating from this side, and the angle observed by De Luc, with an allowance of $\frac{1}{11}$th of the arc for refraction, the height is found 13713 feet above *Pregny*, or 15122 feet above the level of the sea. De Luc himself computed it from the same observation, differently employed in a manner which is little affected by uncertainty in the refraction or the distance, though subject to other error, at 2391 *French* toises equal to 15289 *English* feet: and Sir George Shuckburgh, by a trigonometrical measurement, in which he uses from one station a side of a triangle 206879 feet, and from another one of 142362 feet, and corrects the observed angles by an allowance for refraction equal to $\frac{1}{10}$th of the contained arc, makes the elevation of *Mont-blanc* 14411

* Modifications de l'Atmosphere, § 763.

† Philosoph. Trans. vol. 67. The distance is not there stated, but is easily calculated from the angles and distances exhibited.

and 14453, or, on a mean of the two, 14432 feet above the lake of *Geneva*, and 15662 above the sea.

These instances may authorize an inference, that, in similar measurements of *Dhawalagiri*, *Dhaibún*, and other mountains of the *Himálaya*, from stations some as near, others twice or thrice as distant, the uncertainty respecting the accuracy of the result is not so much greater as to render that result vague and dubious.

Barometrical measurements, though less to be depended upon than a geometric one, would have been desirable, as showing that no very material error has by any oversight crept into it. In the absence of any observations of the barometer on the nearest accessible heights, we are in possession of some made on summits of mountains belonging to the intermediate chain. For instance, at *Chísápání* fort, on the route from North *Bihár* towards *Cat'hmándú* in *Népál*, the barometer was noted on two days at an interval of more than a month (23d February and 28th March 1793), and both observations gave the same length of the column of mercury 24.63. On one of those days the barometer was observed at a spot a little more elevated, near the cold spring which gives name to the place*, 24.43 : and the temperature shown by the thermometer is also given, 65° FAHRENHEIT'S scale at 9 o' clock, and 67° at 11 in the forenoon†. A meteorological journal was kept by Dr. F. BUCHANAN at *Cat'hmándú*, for nearly ten months (April 1802 to February 1803 ‡), and the mean height of the barometer in that period is 25.22. The greatest height being (in May) 25.62 ; and the least (in August) 24.83 §. On a

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* *Népal ; Chísó* cold, *Pání* water. *Sans. S'is'ira-pániya.*

† KIRKPATRICK. *Népál*, p. 52 and 331.

‡ MS.

§ The barometer, by which the journal was kept, gave less length to the column of mercury, than another, with which it was occasionally

minute inspection of it, the changes, though observations were made at four different hours of each day, are small, seldom amounting to the tenth of an inch within the day, and by no means corresponding to the changes of temperature shown by the thermometer.

To compute the elevation of the stations at *Chísápání* and *Cat'hmándú*, under the want of corresponding observations of the thermometer and barometer at the foot of the mountains, we must either seek in some journal, which may have been preserved, a contemporary observation at a station (a very distant one) in *Bengal*, or else be content to take the mean height of the barometer in *Bengal*, where it is very stationary, and seemingly unaffected by changes of temperature.

For here, as in most countries near the tropicks, the barometer has a very confined range, and does not vary with the fluctuations of the temperature, owing to contrary but equal variations of density and elasticity of the air, or other countervailing causes not investigated. The column of mercury stands within a few tenths of an inch of the same height at all seasons of the year *; and exhibits, but within narrower limits, the phænomenon of diurnal tides, which also do not correspond with the rise and fall of the thermometer †. Towards the end of February, the season when the mountains of *Népál* were visited by General KIRKPATRICK, the barometer does not vary in *Bengal* so much as the tenth of an inch above and below 30 inches, while the thermometer in the shade ranges 10°, (from 70° to 80° on a medium,) and much more in an

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compared, and which was constantly higher by a quarter of an inch. The latter agrees more nearly with General KIRKPATRICK's barometer, which in March exhibited 25,87 for the length of the column of mercury at *Cat'hmándú*. The measure of it must be therefore taken as doubtful to one quarter of an inch.

* *Asiatick* Researches, vol. 2, p. 471.

† Ibid. vol. 4, p. 202.

open exposure, between morning and noon. In the months of December and January, the season when the column of mercury is at its maximum*, the mean elevation of the barometer is 30.07, while that of the thermometer is 68°. At *Cat'hmándú*, during the same season of the year, the mean height of the barometer is 25.28, while the thermometer is 52°: seldom altering so much as the tenth of an inch, and never more than 1½ tenths, in the compass of one day, nor during the whole season so much as two tenths for the same hour of the day.

The last of the two methods proposed seems therefore preferable, as the barometer is shown by the journal kept at *Cat'hmándú* to be as little variable in *Népál* as it is in the plains of *India;* and contemporary observations at places very remote (no other could be found) would produce no greater degree of accuracy, since a like state of the atmosphere in respect of elasticity, or in regard to humidity and other circumstances affecting its density exclusive of temperature, is hardly to be presumed to prevail through an expanse of many hundred miles between places so differently situated; the one on the open plain within the reach of influence of the sea, the other in the midst of mountains at the foot of the loftiest Alps. I shall therefore take the mean height of the barometer in *Bengal,* towards the end of February, or 30 inches, and the observed height at the spring of *Chisápáni* at the same season of the year 24.43: and in like manner the mean length of the column of mercury for both *Calcutta* and *Cat'hmándú,* in the winter season, when the mean temperature at the one place as much exceeds the zero of the scale adapted to the measurements of heights, as it is short of it at the other. This appears to be 68° at *Calcutta* and 52° at *Cat'hmándú:* the mean

* *Asiatick* Researches, vol. 2, p. 470.

of both, or 60°, differing by less than $1\frac{1}{2}°$ from the zero of the scale. The corresponding lengths of the column of mercury are 30.07 and 25.28 respectively.

Proceeding on these grounds to calculate the heights of the places, we find from the difference of logarithms *, $753\frac{1}{2}$ *French* toises or 803 *English* fathoms in one instance, and 892 *French* toises or $950\frac{3}{4}$ *English* fathoms on the other: needing little correction for the difference of temperature, the thermometer being near the zero of the scale†. The elevation thus found, corrected, however‡, for expansion of mercury and variation of the density of the air, as indicated by the thermometer, is 5818 *English* feet or $969\frac{3}{4}$ fathoms for *Chisápání*, and 4784 feet or $797\frac{1}{3}$ fathoms for *Cat'hmándú*§, above the plains of *Bengal*. Hence may be inferred the following approximated measures of other stations where barometrical observations were also made, unaccompanied, however, by observations of the thermometer.

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* De Luc, Mod. de l'Atmosphere, § 576 and 631.

† Zero of De Luc's scale, 16.75 of Reaumur's, answering on Fahrenheit's scale to..............	69.32
General Roy's (Philos. Trans. vol. 67, p. 740), adapted to *French* toises	61.4
Thermometer at *Chisápání*, 65°, that at *Calcutta* being 75°; the mean is	70
Thermometer at *Cat'hmándú* 52	
At *Calcutta*...................................68	
Mean of both...............60	

‡ According to the mean of the rules proposed by General Roy and Sir George Shuckburgh; and nearly in conformity to De Luc's, excepting the reduction of 8° in his scale: the numbers being 0.454 for the multiplication of the difference of thermometers, and 0.00244 for that of the mean of both thermometers above 32° Fahrenheit.

§ By another barometer which stood a quarter of an inch higher, the elevation of *Cat'hmándú* above *Calcutta* is 4510 feet; or 4600, nearly, above the sea.

		Feet.
Chandragiri, M	(22.5*)	7989†
Tambékhán, M..................	(23.75‡)	6488
Chísápání, M	(23.8§)	6453
Cumhara, M	(24.22*)	5943†
Bhírbandi, M	(24.28‖)	5875
Sibudhol valley	(24.48¶)	5711

Also, as before,

Cold spring *Chísápání*......................	5818
City of *Cat'hmándú*	4784

And (by a trigonometrical measurement of mountains encompassing the valley of *Népál* **, selecting from it mountains south of *Cat'hmándú*) *Chandragiri* M. above *Cat'hmándú* 3682 feet, and above the sea†† 8466

Palchu M. (above *Cat'hmándú* 4210 feet,).. 8994

It does not seem, then, that the elevation of the pass of *Nágun-ghátí*, whence the mountain near *Jamunáwatárí* was observed, need be thought overrated at so little as the lowest of these heights, which command a similar extensive view of the *Himálaya*.

To recapitulate the result of this minute examination of measurements of the *Indian* Alps, the following are stated as differences of elevation which may be received as near approaches to a correct determination of the

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* Estimated, KIRKPATRICK, *Népal*, p. 331 and 332.

† Doubtful.

‡ KIRKPATRICK, *Népàl*, p. 70.

§ Ibid. p. 57.

‖ Much beneath the summit of the mountain: ibid. p. 139 and 333.

¶ Ibid p. 334.

** Colonel CRAWFORD, MSS.

†† This mountain, by General KIRKPATRICK's doubtful observation of the barometer (22.5), is 7989 feet above the plains of *Bengal*.

height, and as fully substantiating the position which was advanced at the beginning of this paper.

Dhawalagiri or *Dhólágir*; above *Gorakhpur*, which is estimated to be 400 feet above the sea;

On a mean of two nearest observations, and at the lowest computation .... English feet 26462

On a mean of three observations with middle refraction 27677

Above the sea, at the lowest computation.... 26862

Yamunávatárí, or *Jamautrí*; above the summit of *Nágúngháti*, which is estimated to be 5000 feet higher than the sea 20895

Above the sea 25500

A mountain supposed to be *Dhaibun*; above *Cat'hmándú*, which appears by a barometrical measurement to be at least 4600 feet higher than the sea 20140

Above the sea 24740

A mountain not named, observed from *Pilibhít* and *Jét'hpúr*; above *Rohilkhand*, which is estimated at 500 feet above the sea:

On a mean of observations at both stations, 22291, or, more exactly 22268

Above the sea 22768

A mountain not named, observed from *Cat'hmándú*, and situated in the direction of *Cálabhairavi*; above the valley of *Népál*, 4600 feet higher than the sea 20025

Above the sea 24625

Another near it; above the valley of *Népál*.. 18662

Above the sea 23262

A third in its vicinity; above the valley of *Népál* 18452

Above the sea 23052

I take this opportunity of adding to the former communication of Captain Raper's account of the journey

to *Bhadrináth* and to *Rétal*, and *Bét'hári* on the route towards *Gangáwatárí*, the narrative of the prosecution of the journey towards the source of the *Bhágirat'hi* by the *Múnshi*, who was sent from the last-mentioned station to explore that source, and who actually penetrated several miles beyond *Gangáwatárí*. It is taken from the field-book which was kept by him, and of which the original has been delivered to me by Lieutenant WEBB. The route is laid down from this journal in Lieutenant WEBB's map of a survey of the Ganges within the mountains, inserted in the last volume of the *Asiatick* Researches *.

It will be observed that the *Múnshi* crossed the Ganges several times on *Sangas*, or bridges consisting of one or two fir-trees laid across from bank to bank. The breadth of the river, or, which is the same thing, the length of the bridge, was, in the first such instance which occurred, 56 paces. At the second bridge the breadth of the river crossed was 46 paces; half of which consisted of rocks in the middle of the river, and the other half only appears to have been the breadth of the stream. In the third instance the distance from bank to bank was 51 paces; but one-third of this was rock, leaving two-thirds only, or 35 paces, for the width of the stream. The fourth bridge was 45 paces long; but the fifth 28 only: and the sixth appears to have been no more than 25 paces. This was below the confluence of the *Bhágirat'hi* with a rival stream named *Kédárgangá*, and considerably short of the termination of the *Múnshi's* journey. He has not specified the breadth of the river where last seen by him: but, at *Gangáwatárí*, an expansion of the stream is described by him to be 40 cubits wide and two deep, with scarcely any current. The river was traced 3 miles further amidst the snow.

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* Vol. 11, p. 447.

Sunday, 1*st May*, 1808, *set off from Bet'hári, Pergh Taknúr in Garhwál.*

Left hand.	Bearings by Compass.	Paces.	Right hand.
Road level. Ganges distant 200 paces. Name of the place *Bet'háríban.*		622	Across the Ganges, the river *Idrar* in sight; distant ½ coss. Name of the place *Sálkában.*
Mauza *Kiárkhí* in sight; distant ½ coss. A small stream from the mountain flows towards the Ganges. The river 100 paces distant. Road over rocks; difficult.		320	
Road level over rocks. Ganges very near.		800	R. *Jamca*; distant ½ coss.
Ascent. Ganges 400 or 500 paces distant.		150	
Descent. Ganges 250 paces off.		128	
Over rocks near the river; extremely difficult.		192	
A small stream from the mountain falls into the Ganges.		11	
A grotto resembling a veranda, near the road.		56	
Torrents, fifty or sixty paces wide, running with great violence towards the river, 200 paces off.		857	
A grotto capable of containing ten or fifteen persons; river as before.		135	
Ascent.		80	
Level road on the high ground. Ganges 400 paces distant. A village in sight, ¼ coss off.			
Ascent. Ganges ¼ coss off.		540	
Level. River as before.		200	

Left hand.	Bearings by Compass.	Paces.	Right hand.
Over rocks; very difficult.		320	
A grotto capable of containing 25 persons.		240	
Road level. River still as before.		408	
Descent: to the bank of R. Soar.		309	
Cross R. Soar, by a *Sanga.*		14	
The water touched the bridge and flowed with rapidity. Ganges ½ coss distant. Ma. Murar in sight on an eminence.			
Ascent.		32	
Road along the side of the mountain.		1208	A large village, *Sálang*, and river of the same name; distant ½ coss.
Descent*.		320	
Road along the side of the mountain.		174	
Descent to the bank of the *Cúchián* N.		560	
Ford of the *Cúchián* N.†.		5	
Ascent of mount *K'hontá*‡.	N. 3 points E.	848	
Road descends.		704	
Ascends again.		128	
Descends.		205	
Ford of the *Taur* N§.		2	
Road along the side of the mountain‖.		997	
Level.	N.2 points E.	59	

* Ganges 500 paces off.

† Ganges ¼ coss off. The village of *Cúchián* in sight on the height.

‡ Name of the place *Agrákhá*. Ganges ½ coss distant.

§ This stream comes from North 7 points West. Ganges still ½ coss distant. Rained at noon. We ate bread on the bank of the stream.

‖ Lower down, a grotto capable of holding 25 persons.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Ascent of mount *Tuwárá**.		2264	
Descent.	N. 4 points E.	176	
Ascent. A large grotto seen.		168	
Descent along the side of the mountain to the banks of the *Tiar* R. Ganges ½ coss off.		1392	
Ford the *Tiar*†.	N. 5 points E.	18	
Road level; a little undulating‡.		1283	
	Total	16865	paces.

Monday, 2d May, proceeded.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Road leads over rocks of the Ganges. Stream distant 500 paces.	N. 3 points E.	283	River *Datai* in sight, ½ coss distant. It comes from mount *Kailás*. N. 6 points E.
Ascent of Mount *Capar Khola*. Ganges ¼ coss distant.		1248	Flows with great rapidity.
Road level. A small grotto. Ganges ¼ coss distant.	N. 1 point E.	464	
Road undulating to the banks of the *Khót-mári*. Ganges ½ coss distant.		496	
Ford the stream §.		3	
Ascent.	N. 2 points E.	112	
Road level on the high ground.		208	Water of the Ganges appeared like mud.
Along the side of the mountain. Ganges ½ to ¾ coss distant.		960	

* Village of *Tuwárá* in sight. A small grotto. Ganges ¼ coss distant.

† The stream comes from N. 2 points E.

‡ Ganges 500 or 600 paces distant. Stopped for the night in a large grotto or place sheltered by rocks. Rained the whole night.

§ It comes from N. 1 point W. Falls in a cataract of 20 cubits high.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Crossed the *Réri**;		8	
Descent along the side of the mountain. Ganges 1 coss distant.		1336	
Ascent. Ganges 400 paces off.	N. 6 points E.	355	
Along the side of the mountain †.		1280	
Road level. Ganges 200 paces distant.	N. 2 points W.	1486	R. *Nar* 1 coss distant. Comes from N. 2 points E. A cataract 7 cubits high.
Road level.	N. 3 points E.	193	
Road level. A grotto seen. Ganges 500 paces off.		200	
Road level.		888	R. *Rúnká* 1 coss distant, N. 7 points E. A hot spring from the side of the mountain called *Rárśicund*, on the bank of the Ganges.
Road level ‡.		42	
Road level to the banks of the *Calyáni*.		349	
Cross the rivulet. Ganges ½ coss distant.		2	
A *Dhermsala* at *Banghéli*. Some fields of cultivation. Ganges 600 paces off.	N. 7 points E.	214	The *Malicha* falls into the Ganges. It flows from N. 7 points E.
Level. Ganges 500 paces distant.		266	
Ascent along the side of the mountain. Ganges ¼ coss distant.	N. 5 points E.	1110	
Descent by a similar path. Ganges 200 paces off.		1154	

* It comes from S. 7 points E. Ganges less than 1 coss distant. Halted at noon to eat bread. It rained.

† The *Réri* falls into the Ganges. This is 50 paces [wide].

‡ A small stream from the mountain's side falls into the Ganges.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Ford of the *Banghéli* N. It flows from N. 2 points W.		11	
Road level *.		280	
Road level to the Ghat.		186	
Crossed the Ganges by a *Sángá*, or spar bridge, 1½ space wide †.	N. 7 points E.	56	
		128	Ascent. Ganges 200 paces distant.
		320	Road level.
		80	Along the side of the mountain.
		800	Same. A torrent crosses the road.
		249	Level along the edge of the Ganges ‡.
		480	Road level §.
R. *Kanéla* in sight, a coss distant: comes from N. 3 points W.		152	
		800	Road level: a grotto seen. Ganges 200 paces distant.
		1280	Road level ‖.
		120	Road level ¶.
	Total	17609	paces.

Tuesday, 3d May.

	N. 2 points E.	325	Road level to *Déoráni*, a rivulet from N. 5 points E.

* A deserted hut of herdsmen. Ganges 300 paces off.

† The stream was 30 cubits below the bridge. The *Sángá* consisted of two or three spars, with a few pieces of wood tied on them. It was not a safe bridge. Having crossed, have now the Ganges on the left hand.

‡ A fir-tree, which had fallen in, rested against the bank.

§ A grotto seen: might hold 50 people.

‖ A torrent from the mountain passes close to the road.

¶ Stopped for the night at a large grotto, capable of containing 40 persons, 200 paces from the Ganges. Slight rain all night.

Left hand.	Bearings by Compass.	Paces.	Right hand.
		3	Forded the *Déoráni*.
	N. 5 points E.	378	Road to *Déoráni ghát* of the Ganges.
		46	Crossed the Ganges by a *Sángá*, or bridge of spars *.
Ascent.	N. 2 points W.	40	
Level road.		400	
Descent.		40	
Level.		688	
Over the snow.		182	
Road level.	N. 2 points E.	48	
Ascent.		40	
Level. A small grotto seen.		120	
Crossed the Ganges at the *Ghát Lóhárinág* by a *Sángá*, or bridge of spars †.		51	
		358	Road almost level, over rocks.
		59	Road level.
	N. 4 points E.	1095	Road level along the mountain's side. Ganges 100 paces off.
		19	Crossed the *Lôtgárh* by a *Sángá*, consisting of 4 timbers ‡.
		480	Over rocks on the edge of the Ganges.
		296	Over snow which had fallen on the bank of the Ganges.
	N. 7 points E.	184	Proceeded over rocks in the Ganges.

* It consisted of three small spars, and was ½ a pace wide; very dangerous and terrifying. Went over it in a sitting posture, sliding along. The wooden part 24 paces, of which 11 very dangerous, and 13 more easy. The rest (22 paces) on rocks in the Ganges. The stream 7 cubits below the bridge.

† Two paces wide, and five cubits above the stream. Wood 25 cubits. Rock 21 cubits. Wood 10. Rocks 5. Ganges again on the left hand.

‡ It was 2 paces wide, and was touched by the water, which flowed with great rapidity. This stream comes from *Himáchal* N. 7 points E.

Left hand.	Bearings by Compass.	Paces.	Right hand.
		464	Ascent of the mountain, which was very steep. Climbed, holding by the grass and small shrubs.
		88	Descent towards the Ganges: went in a sitting posture.
		16	Road level.
		40	Ascent; very steep and difficult.
		104	Level.
		48	Ascent very difficult; overhangs the Ganges.
		112	Level. Ganges 200 paces off.
		131	Ascent; steep and difficult.
		56	Descent; extremely steep.
		462	Ascent. Ganges 250 paces off.
		272	Level. Ganges 150 paces distant.
		64	Over rocks on the edge of the Ganges.
		168	Descent from rocks; very steep.
The *Jelárí* R. in sight, one coss distant, comes from N. 7 points E. and snowy mountains seen N. 7 points W. distant one coss.		831	Over rocks of the Ganges; but less difficult.
		1544	Road level; over stones in the bed of the Ganges*.
		56	Level.
		192	Ascent.
		232	Descent.
		145	Over the rocks of the Ganges; very rough and difficult.
		192	Ascent.

* A cave or grotto seen, and a small one capable of containing 50 persons.

Left hand.	Bearings by Compass.	Paces.	Right hand.
		320	Level, along the bank of the Ganges.
		96	Ascent.
		200	Descent.
		653	Over rocks of the Ganges; extremely rough and difficult.
	N. 4 points E.	11	Cross the *Bhélá* by a *Sángá* *.
		135	Level.
	N. 7 points E.	54	Cross the Ganges at the *Ghát* of *Súkh*, by a *Sángá* †.
Ascent, along the side of the mountain.	N. 7 points W.	659	
Along the side of the mountain to *Súkhí*. Ganges one coss distant.	N. 7 points E.	1654	
Along the side of the mountain.		840	
Ascent.		552	
Descent. Ford the *Choraki* N. ‡.		1248	
Road level. Ford the *Pakchahár* §.		523	
Road level. Ford the *Gangátrí* N. This flows from N. 7 points W.		117	
Ascent to *Jhálá*; which is 100 paces from the Ganges ‖.		184	

* Five cubits above the water. The stream comes from S. 1 pt. E.

† One pace wide, five cubits above the water. The old one had been broken down, and a new one had been recently erected. The greatest part of the distance in crossing was over rocks, viz. Rock 26. Wood 17. Rock 11.

‡ Comes from N. 7 points W. Ganges 200 paces off.

§ It comes from S. 1 point W. Ganges 100 paces off.

‖ Slight rain. Snowy mountains on all sides, and apparently very near. In the middle of the night much snow fell. In the morning the whole forest, and the surface of the ground and roofs of houses, were covered with snow. Halted till noon of next day.

4th May.—Proceeded at noon, when the snow was a little cleared away.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Road level.	N. 2 points W.	496	
Ford the *Nibàni* N. It comes from S. 7 points E. Ganges 200 paces off.		11	
Along the side of the mountain.	N. 7 points W.	640	
Descent. Ganges 2 to 300 paces off.		699	
Road level.	N. 5 points E.	400	
Cross the *Shinán* by a *Sángá* *.		32	
Road level.		40	
In the shallow bed of the Ganges.		70	
Over stones in the Ganges.		37	
In the shallow water of the river.		59	
Over stones.		35	
In the shallow water.		11	
Over stones along the edge of the river.		562	
In the shallow water †.		48	
Along the banks of the Ganges ‡.	N. 2 points E.	336	
Ascent.		48	
Along the side of the mountain.		528	
Over the rocks of the Ganges, very rough and difficult.		1000	
Cross the *Gongti* by a *Sángá* §.		22	
Road level. Ganges 250 paces off.	N. 7 points E.	531	

* The stream comes from N. 2 points W.

† Two channels of the river here unite.

‡ The melted snows descending from the mountains.

§ The water touched the bridge. Stream comes from N. 5 points E.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Cross the *Harsilá* by a *Sángá* *.		14	
Road level. Village of *Cachórá*.		280	
Ascent of the mountain near *Cachórá*.		160	
Level road.		320	
Continued ascent of the same mountain.		424	
Descent †.		1024	
Road level.		368	
Ascent. Along the side of the mountain.		256	
Descent. Along the side of the mountain. River very near.		533	
Cross by a *Sángá* near *Dherálí* ‡.		14	
Level road over the rocks of the Ganges.		144	
Cross the Ganges by a *Sángá* §.		28	
The deserted village of *Súkhia* in sight across the Ganges.		96	Level road to the temple of *Mahádéva* ‖.
Khera N. descends from *Cailás*.		96	Arrived in the evening at *Dheráli* in Pergunna *Tacnúr* ¶.
	Total	9002	

5th *May*.—*Proceeded from Dheráli.*

	S. 5 points E.	160	Ascent.

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* The stream comes from N. 7 points E.

† A stone representing *Mahádéva*, on a mountain said to be *Cailás*, was in sight from *Cachórá*, bearing N. 5 points E.

‡ Five cubits above the water.

§ At the *Ghát* of *Dherálí*. The water rises within 5 cubits of the bridge. The Ganges is now on the left hand.

‖ Containing a stone *linga* to represent the deity. It was buried in the sand. The temple said to have been founded by *Sancaráchárya*. Other houses to the number of five or six.

¶ Containing near 25 huts, of which only 5 inhabited.

Left hand.	Bearings by Compass.	Paces.	Right hand.
		400	Descent. Ganges 200 paces off.
		416	Level road. A stream from the mountain crosses the road.
		792	Over rocks on the edge of the river.
		14	Crossed the *Gangá-sárti* by a *Sángá* *.
	S. 5 points E.	1000	A stream from the mountain crosses the road. Ganges 250 paces distant.
		320	Road level: but over rocks.
		96	Level: over snow.
		864	Level: over rocks. Ganges 300 paces distant.
		160	Level: over snow.
		480	Level: over rocks. Ganges 200 paces distant.
		80	Level: over snow.
		400	Level: Ganges 200 paces distant.
	N. 5 points E.	480	Ascent.
		320	Level: Ganges 400 paces distant.
		496	Descent: Ganges 300 paces distant.
R. *Gúmgúm* in sight, one coss distant †.		80	Level: A torrent from the mountain S. 1 point E.
		160	Level.
		249	Over snow. A stream from *Changthanga*.
		240	Level: Ganges 300 paces off.

* The stream is very rapid, and comes from Mount *Cailás*, S. 3 points E.

† Comes from N. 2 points. Is crossed by a *Sángá* on the road to *Bhót (Thibet)*.

Left hand.	Bearings by Compass.	Paces.	Right hand.
	N. 6 points E.	488	Level.
		80	Over snow.
		533	Level. A stream from *Changla* crosses the road.
		445	Level. Ganges 4 or 500 paces distant.
		1064	Along the side of the mountain.
		14	Cross the *Laconga* by a *Sángá* *.
		240	Level.
		240	Ascent of Mt. *Ratúnti*.
		312	Level: over rocks.
		120	Ascent.
		96	Level: over rocks.
		64	Level: over snow.
		160	Level. Ganges 300 paces off.
		64	Ascent.
		560	Along the side of the mountain.
R. *Jáhní-gangá* from the *Himáchal* mountains. Comes from N. 6 points E. Flows with great rapidity; and joins the Ganges. A *Sángá* over it leads towards *Bhót* (Thibet).	N. 5 points E.	1588	Level: over rocks.
		184	Level: over rocks †.
		512	Road undulating. Descent by means of a short ladder.
		16	Level. A stream from the mountain crosses the road.
		25	Cross the Ganges by a *Sángá* at *Bhairógáti* ‡.
A figure of *Bhairólál*.§		168	
Ascent ‖.		144	
	Total	15032	

* It comes from Mount *Cailás* S. 5 points E. Ganges 200 paces off.

† *Cál-bhairó*: a mere heap of stones, with no idol. Walnut-trees. Ganges 500 paces off.

‡ The stream appeared to be 500 cubits below the bridge.

§ Carved in the stony scarp of the mountain. Two idols of stone, daubed with minium. Pilgrims make offerings here, and proceed.

‖ Halted in a grotto which might contain 100 persons.

6th May.—Proceeded on the journey.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Ascent by means of ladders.	N. 7 points E.	299	
Ascent of the mountain*.		400	
Level: over rocks †.		1080	
Level: a plain.		80	
Level: over rocks ‡.		1035	
Level §.		336	
Along the side of the mountain.	N. 6 points E.	840	
Level ‖.		400	
Level. Over rocks. Ganges 400 paces off.		2000	
Level. Over rocks ¶.		752	
Level. A stream from *Terálí* crosses the road.		452	
Level. Halted in the grotto of *Terálí*. Fir-trees. Ganges 400 paces distant.		576	
Level.	N. 7 points E.	40	A stream from the snow on the other side of the river. Distant ½ coss.
Level. Road crossed by a stream from the mountain.		411	
Level: over rocks **.		444	
Level: over rocks ††.		1392	

* A temple of wood, containing an image of *Bhairólál*.

† A stream from *Banlago* crosses the road in three places, towards the Ganges. Comes from S. 7 points W. Ganges 500 paces off.

‡ A stream from Mount *Matwári* crosses the road.

§ Halted in a grotto of *Matwári*. Ganges 400 paces distant.

‖ A stream near the deserted village of *Himún*, from the mountain, across the road.

¶ A stream near *Bhandrá* (formerly a village), comes from the mountain across the road.

** Grotto of *Otsaro*, capable of containing 20 persons. Ganges 300 paces off.

†† Many torrents from the mountain cross the road and fall into the Ganges. River 250 paces distant.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Level. A stream from *Otsaro* crosses the road.		818	
Level: over rocks*.		1064	
Level: over rocks†.		1120	
Level: over rocks‡.		3200	
Level: over rocks.		104	R. *Bhój* from S. 2 points E. Distant ½ coss.
Level: over rocks §.		1104	
Level: over rocks ‖.		584	
Level: over rocks. *Télálóní* ¶.		176	
Level: along the edge of the river**.		1448	
Level. Arrive at *Gangáwatrí* ††.		580	
	Total	20839	

* A foaming torrent crosses the road called *Megmerá* or *Shírcai.* Falls into the Ganges.

† A grotto capable of holding 10 persons. Ganges 250 paces off.

‡ A torrent passes near the road. Falls into the Ganges. The river 200 paces distant.

§ *Patágní*, where the *Pándus* are said to have performed a sacrifice. Ganges 200 paces off.

‖ A torrent falls into the Ganges. *Pakora* and *Cachori:* a spot surrounded with red marks, where the *Pandus* are said to have prepared their victuals. River 300 paces distant.

¶ A spot named from salt and oil, which might formerly be perceived, but not so now.

** *Gauricund*, a pool in which the water collects, and whence a stream proceeds. Confluence of *Kédárgangá* from S. 5 points E. with *Bhágirat'hí* or Ganges from N. 7 points E. Hindus shave and bathe here preparatory to visiting *Gangáwatrí*.

†† On the banks of the Ganges. A wooden temple, containing the footstep of *Gangá* on a black stone. *Súryacund*, *Vishnucund*, and *Brahmecund*, within the Ganges, being names assigned to distinct portions of the river, where pilgrims bathe. The last is 40 cubits wide, and 2 deep. It is the pure *Gangá*, unpolluted by water of any other stream. *Bhágirat'hi-sílá*, a large rock in the river, on which the king *Bhágirat'ha* worshipped the deity. The river comes from N. 7 points E., and has very little current. Scarcely any trees but the *Bhójpatr* (birch?). On all sides snow. A large temple roofed with wood, containing an image of *Gangá* in red stone, a small female

7th May.—Proceeded onwards.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Road level: over rocks of the Ganges.	N. 7 points E.	1320	
Road level: the river might now and then be perceived amidst the snow.		1416	
Road level: on rocks in the Ganges*.		496	
The Ganges might now and then be perceived under the snow†.		968	
Along the bank of the Ganges: over rocks‡.		760	
Over snow, filling the bed of the Ganges§.		2640	
Over rocks along the banks of the Ganges, which here shewed itself‖.		520	

figure of silver, images of *Mahádéva* and *Párbatí* in red stone represented with the human form, *Bhágirat'ha*, *Annapúrná dévi*, *Vishnu*, *Brahmá*, and *Ganés'a*, in red stone. A *Bráhmen*, who is an inhabitant of *Dherálí*, attends here during three months, *Vaisák'h*, *Jyét'h*, and *Asárh*. Scarcely any but *Bairágis* and *Sannyásís* come here: the road being in the highest degree difficult, and the place amidst snow most inhospitable.

* The breadth still less than at *Gangáwatrí*. On one side the road is practicable. On the other a perpendicular wall of rock. In the bed of the river saw a rock 2 or 3 paces wide and 5 long, bathed by the river on both sides, and overhanging the stream; the depth of water being very small. This rock exhibits a similitude of the body and mouth of a cow. It is called *Gao-múc'h*.

† An image of black stone might be seen in the snow; but could not be approached, for fear of being buried in the snow. The road was over the snow of the Ganges.

‡ A large cavern, quite capable of containing 100 persons: consists of several apartments.

§ The river was not once seen, nor was any sound of its current heard. The snow, being soiled, appeared like the earth of cultivated fields.

‖ In front was a steep mountain like a wall of rock, from an angle

8th May.

Set off to return by the same road towards *Dherálí*, there being no other practicable route.

The sequel of the field-book is kept in a similar manner; but it is thought unnecessary to translate it.

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of which the Ganges appeared to come. Beyond the present station was nothing but snow, nor any road but that termination of the valley. From dread, none would venture into the water of the Ganges. The snowy tops of the mountains appeared of various height; and not the least sign of vegetation: nothing but snow, masses of which were falling from the mountains. As the people in company were deterred from advancing, and there appeared no road by which to penetrate, and further progress seemed full of peril and of terror, I was under the necessity of returning to *Gangáwatrí*.

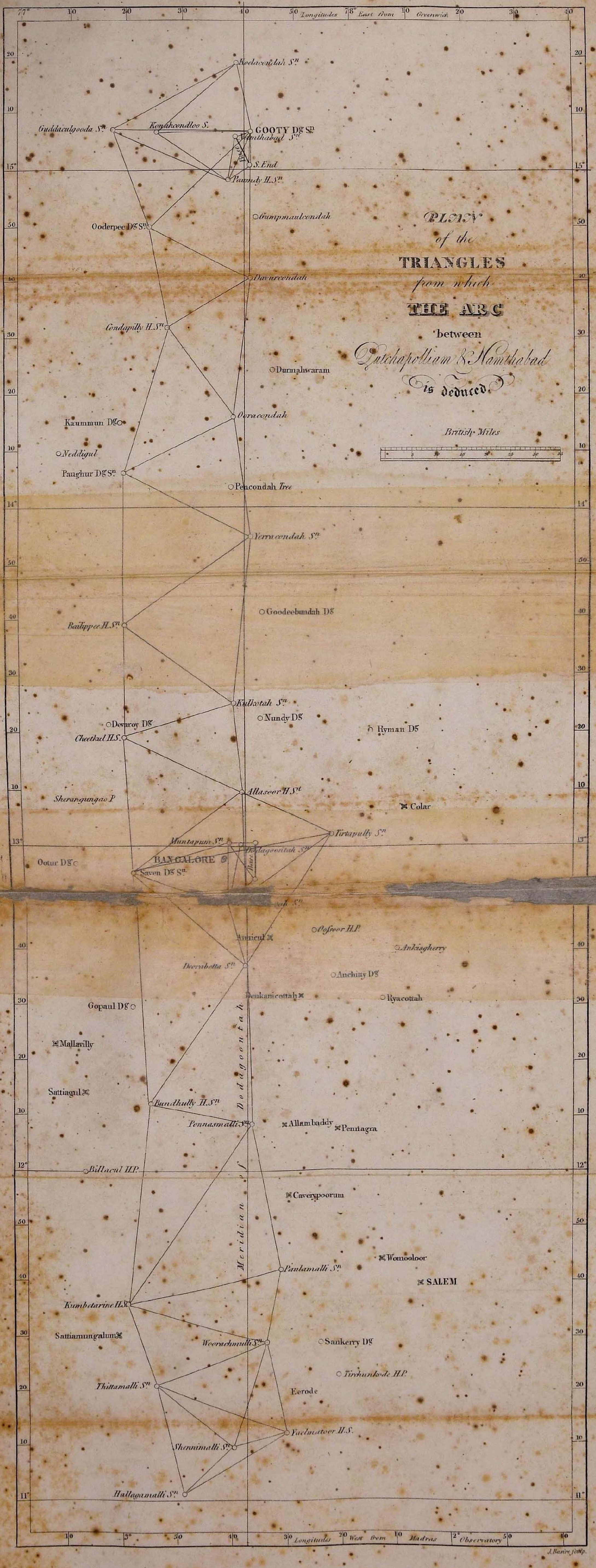
VIII.

An Account of the Measurement of an Arc on the Meridian, extending from Latitude 10° 59′ 49″ *to* 15° 6′ 0″.65 *North.*

BY MAJOR WILLIAM LAMBTON,
33d Regiment of Foot.

IT is with much satisfaction that I have it in my power to state to the Society the success which has attended a further extension of the grand meridional arc, and the conclusive results from another series of astronomical observations at a station near *Gooty*, in latitude 15° 6′ 0″.65. I am thereby enabled to set aside entirely those doubtful observations at *Dodagoontah*, so often mentioned in my former communications; not, however, without some regret at the necessity of so doing; because I wished to have noticed the progressive increase of the degrees on the meridian, as I advanced to the northward, by arcs not more than two degrees in amplitude. However, as the case stands at present, it is fully satisfactory. The whole arc is 6° 56′ 22″.25, and it may be considered as consisting of two sections; one of 2° 50′ 10″.5, the southern one, which gives the degree 60473 fathoms nearly, for the latitude 9° 34′ 44″, the middle point of that degree, as appeared from my last paper (in the commencement of the present volume of the Researches). The other section is 4° 6′ 11″.28 in amplitude, and lies to the northward of the former. This gives the degree due to the

Pl. III.



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middle point, or latitude 13° 2′ 55″ equal to 60487.27 fathoms. Also the degree due to latitude 11° 37′ 49″, the middle point of the whole arc, is 60480.42 fathoms. So that, for latitude 9° 34′ 44″, the degree is 60472.91 fathoms; and for latitude 11° 37′ 49″ the degree is 60480.42 fathoms; also, for latitude 13° 2′ 55″, the degree is 60487.27 fathoms. These, being deduced from actual observations, afford a regularity in the increase exceeding my most sanguine expectations.

The recent measurement is a continuation of the former triangles in 1805 and 1806, commencing on the distance *Paughur* and *Yerracondah*, and terminating at the station of observation about three miles West from *Gooty*, where a base line has been measured as a verification to the present, and a foundation for a farther extension of a future series of meridional triangles. And, to render this account of what has already been done complete, I have here included the whole number of triangles, from the base in *Coimbetoor* to that near *Gooty*. A particular account of the measurement of the base near *Bangalore* has already been given in the 10th volume of the *Asiatick* Researches; of course it is not necessary to repeat it here. That base is therefore only taken up as a new datum, from which the triangles are carried southward to the stations *Ponnassmalli* and *Kumbetarine* hill, and northerly to *Paughur* and *Yerracondah*, and then recourse is had to the last measured base near *Gooty*. Hence what is given here, together with what appears in the 10th and present volumes of the Researches, will furnish an entire account of the whole arc in its present state of progress; and its future extension will, I hope, be more in the order of time, as a meridional series will be chiefly attended to; and it may be gratifying to the intelligent reader, who is interested in subjects of this nature, to know that these operations are to be extended through the *Dekkan;* which, if no local difficulties occur, may be carried to the northern confines of the NIZAM's dominions, consi-

derably beyond the latitude of 20 degrees. It however may be doubtful as to the practicability of extending it so far, in the present state of that country; but I hope I shall have no difficulty in penetrating as far as the latitude of 18 degrees, and perhaps my next observations may be on the banks of the *Goodavery*. It is scarcely necessary to mention here, that the number of years elapsed, since the commencement of this arc in 1805, has been owing to the time taken up in extending the survey over the whole Peninsula. The base near *Gooty* has been the foundation of a series of triangles connecting *Masulipatam* with *Goa*, which I expect will be completed in 1813, and after that my whole attention will be directed to the northward, where, having only the meridional series to attend to, my progress in that direction must consequently be more rapid.

Besides the purpose of extending this arc to the northward, there is another object of equal importance, which is the measurement of a perpendicular arc, in a latitude as far north as it is possible to penetrate. It is from these perpendicular arcs that a scale is obtained for computing the relative longitudes; and when this survey is carried through the *Circars*, it will be of great importance to determine the positions of places along the sea-coast. Some of those places, according to Major RENNELL's account, are laid down from observations formerly made under the direction of Colonel PEARSE, on his route from *Madras* to *Calcutta*, in 1784; but his route was chiefly inland after crossing the *Kistna*, touching the coast in very few places; and his positions are laid down only in latitude. Others are fixed from Major STEPHEN's survey; but the data seem to have been insufficient. Even astronomical observations are incompetent to fix the relative longitudes of a number of places within a few miles of each other. To determine the measure of a degree perpendicular to the meridian affords the only correct means: and with these low latitudes

great nicety in the observations is necessary. It therefore becomes an important desideratum to obtain an accurate scale for computing longitudes, and the more northern latitudes afford the surest results.

I have already noticed that these meridional operations were begun in 1805. The base near *Bangalore*, measured in 1804, was the first foundation, and its height above the sea was determined from a series of triangles brought from the *Coromandel* coast, and commencing from a base near *St. Thomas's Mount*. The perpendicular height above the sea of every great station was determined in the usual manner, by using the contained arcs between two stations; a method so well known, that it is needless to explain it here. An account of those heights, with the terrestrial refraction as observed at every station in going direct from sea to sea, is given in the 10th volume of the Asiatick Researches.

In 1805, on my return from the *Malabar* coast, the meridional triangles were begun at *Paughur* and *Yerracondah* (see the plan), and brought down to the base near *Bangalore*, from which other triangles had been extended southerly in 1804, for the purpose of obtaining sides of a great length, for measuring a perpendicular arc, but which answered exceedingly well for the meridional series. In the beginning of 1806, that series was resumed, and carried down to the *Coimbetoor* country, where a base was measured, and a choice collection of zenith distances observed, an account of which was given in my last communication, which gives the particulars of the southern section of this arc.

In 1811, the triangles were again taken up at *Paughur* and *Yerracondah*, and carried up to *Gooty*, for determining as usual the height of that base above the sea; but when that measurement was computed, and reduced to the level of the sea, the triangles were computed back to

the distance *Paughur* and *Yerracondah*, differing from the same distance brought from the base near *Bangalore* $1\frac{4}{10}$ feet, which, proportioned to the measured base near *Gooty*, will make a difference of $3\frac{6}{10}$ inches, supposing it to have been computed as a side of the last triangles brought out from the base near *Bangalore*. The superintendence of these triangles was intrusted to Lieutenant RIDDELL, of the Company's service, while I was measuring the base, and observing zenith distances; and thus terminated these operations; a summary account of which I have thought it necessary to give, because they have been carried on at intervals only, and, in point of time, bear but a small proportion to that taken up on the geographical scale.

In the present volume of these Researches, I have given the general formulæ for determining the figure and dimensions of the earth, taking my own measurements as stated in that account, and the different measurements in *England*, *France*, and at the *Polar Circle*, from which a mean result is had, for determining the rates of the *Polar* to the equatorial diameter.

The present degree in latitude 11° 37′ 19″, compared with the *English*, *French*, and *Swedish* measurements, will give an ellipticity of $\frac{1}{300.96}$; but I forbear making any deductions till I have done all that I mean to do in the meridional measurements, and until I know further respecting the operations carried on in *England*.—When these arcs are extended as far as it is practicable, some final conclusions may then be drawn with respect to the figure and dimensions of our earth. For what has been done by those eminent men sent out to different countries in the last century seems to have left the question more involved in uncertainty than it was before. BOUGUER appears to have been the most correct; and had he taken any other measurement made in the northern latitudes, rather than that of MAUPERTUIS, to compare with his

own, his hypothesis might have been near the truth.— The degree given by the ABBE' DE LA CAILLE is as inconsistent as that of MAUPERTUIS ; and he draws a conclusion equally inconsistent with the doctrine of rotatory motion, viz., that the meridians in the southern hemisphere have a different curvature to those in the northern, or that the degrees of longitude in the same latitude are different in the two hemispheres. I wish to see that measurement put to the test. MAUPERTUIS has been found, by the members of the *Swedish* academy, to be out upwards of 200 fathoms, which circumstance cannot but tend to lessen our confidence in the *Abbé's* performance at the *Cape of Good Hope.*

In the sequel of this paper I have added, as in my last, a table, shewing the perpendicular heights of the stations above the level of the sea. The base lines are all on the table land, and it may be curious to notice their comparative heights. The table land in the neighbourhood of *Bangalore*, and towards *Ooscotta* is upwards of 3000 feet above the sea. The table land, or rather the general height of the low country in *Coimbetoor* (for it is much undulated), is about 900 feet. Towards *Tinnevelly* it falls to between four and five hundred feet. The fall to the northward of *Bangalore* is very rapid after passing *Nundydroog ;* and the summit of *Paughur*, which rises high from its base, is nearly upon a level with the table land near *Bangalore.* The mean height of the base near *Gooty* is 1182 feet, which is nearly the mean height of the flat country extending round *Gooty* and *Bellary*, from which plain the mountains and hills rise like islands from the sea. These facts being established, it is not difficult to account for the different temperatures in the different districts at the same, and at different, seasons of the year. In carrying on my geographical operations I have been particular as to the heights, and the general ranges of mountains, for they form the most prominent features of the country, and such information might aid the researches

of intelligent medical men in their investigation of the causes of those diseases, which are so fatal in some parts of the Peninsula. There are some remarkable facts with respect to the country to the westward of *Bangalore.* After passing the range of hills, in which *Savendroog, Paughur,* and several other stations are situated, the country has a sudden descent, and continues low considerably to the westward of *Seringapatam,* where it begins again to rise towards the mountains called the western ghauts, which are in general from two to three thousand feet higher than those which form the eastern ghauts. *Seringapatam* therefore, and all the country north and north-easterly towards the ceded districts, is a valley, upwards of a thousand feet below the table land round *Bangalore,* descending as we advance to the northward. The *Savendroog* range forms a kind of barrier to the east, but a more complete one is formed to the westward, by those stupendous mountains which form the ghauts, a number of which are from five to six thousand feet above the sea. The countries of *Canara* and *Malabar* lie immediately below these ghauts, and the sea is every where in sight. These countries are low, but broken, and much interspersed with back-water, rivers, and extensive ravines, shaded with forest and jungle, and filled with population; for the upland is barren, and it is in these ravines, and on the banks of the rivers, where all the inhabitants reside. In the month of February the low country becomes excessively hot, and the vapour and exhalation so thick, that it is difficult to see to the distance of five miles. I have viewed this curious laboratory from the tops of some of the highest mountains, where I was scarcely able to bear the cold. The heat increasing during the months of March and April, a prodigious quantity of this moisture is collected, which remains day and night in a floating state, sometimes ascending nearly to the height of the mountains, where it is checked or condensed by the cold; but immediately after descending it is again rarefied, and becomes vapour before it can reach

the earth; and in this state of floating perturbation it remains till the setting in of the western monsoon, when the whole is condensed into rain, some falling on the low country, some among the mountains, and what escapes is blown across the *Mysoor*, and immediately over this valley, which I have just mentioned. This account is foreign to my present purpose; but I trust I shall be pardoned for the digression, as it is a statement of facts relative to a part of the country, which has been a grave both to Europeans and natives, ever since the fall of *Seringapatam*.

I have also added a short table of the latitudes and longitudes of places, depending on the meridional arc. It is not my intention here to animadvert on the geography of the Peninsula, as we have had it handed to us in the printed maps. These, it is true, are erroneous; but when we consider the materials from which they have been compiled, and the total impossibility of procuring better, we must allow that great credit is due to those gentlemen who have had the perseverance and industry to compile them. I can now speak with confidence with respect to the Peninsula in general, in which, in the course of this and the next year, every place of note will be laid down, from *Cape Comorin* to *Goa* on the west, and *Masulipatam* on the east, including all the interior. These, which fall within the limits of the meridional triangles, will serve as a specimen of what has been done elsewhere, and the reader can compare their positions with those in the printed maps. I only hope that the next maps of the Peninsula, if any should be published, will be constructed from other materials besides what are furnished by military marches and perambulators. These may do in the hands of a Quarter-Master General, who wants the actual distances that troops have to march, and not the distances reduced to the chords of arcs; nor does it matter to him whether the armies march on the surface of a spheroid or of a sphere, or on a flat. But, when such materials are intended for geographical purposes, it

becomes necessary to have the outlines, at least, of a general map, on correct principles, so that the distances, however crooked and winding, may be adjusted, and fitted to those laid down with mathematical accuracy. Under these limitations, the materials furnished from military marches may be eminently useful.

I shall conclude by expressing my earnest hope that nothing will happen to prevent my fulfilling what I have here held out to the learned reader: and, were any incitement wanted to accelerate my exertions, it would necessarily arise from reflecting on the liberal and flattering treatment which I have experienced from this and the supreme Government; and which must ever continue to animate my zeal, and excite the most lively feelings of gratitude.

W. LAMBTON.

Bellary, Nov. 17, 1812.

Triangles connecting the Base in Coimbetoor with the Base near Bangalore.

In the present volume, page 43, the distance from *Hallagamalli* to *Yaelmatoor* is brought out in the 10th triangle from the base line.—This distance is the base for proceeding northerly.

ANGLES.

At Hallagamalli Station.

BETWEEN	AND				
Thittamalli Station....	Yaelmatoor Station....	72°	11′	51.″ 51.5	51.″25
Shennimalli Station	..Thittamalli Station....	59	20	59.5 59. 61.25 61.5	60.31

At Shennimalli Station.

		°	′	″	″
Hallagamalli Station	..Thittamalli Station....	84	00	13.5	15.56
				16.5	
				15.5	
				16.75	
Woorachmalli Station	..Yaelmatoor Station....	56	51	35.5	35.75
				36.	
				35.75	
	Kumbetarinemalli Station	53	22	28.5	29.08
				30.25	
				28.5	

At Yaelmatoor Station.

Shennimalli Station	..Woorachmalli Station..	93	31	35.75	34.37
				33.	
Hallagamalli Station	..Thittamalli Station....	51	55	10.	11.37
				12.75	

At Thittamalli Station.

Shennimalli Station	..Hallagamalli Station ..	36	38	45.62	46.37
				46.25	
				47.25	
Hallagamalli Station	..Yaelmatoor Station....	55	53	3.5	2.25
				0.75	
				2.5	
Shennimalli Station	..Woorachmalli Station..	61	19	22.5	23.66
				23.62	
				23.75	
				24.75	
Woorachmalli Station	Yaelmatoor Station....	42	5	6.	7.4
				5.25	
				8.5	
				7.5	
				9.75	
Woorachmalli Station	Kumbetarinemalli	87	23	44.5	43.7
				43.5	
				43.5	
				44.75	
				42.25	

At Woorachmalli Station.

		°	′	″	″ (mean)
Shennimalli Station	..Yaelmatoor Station....	29	36	57.75	
				56.75	
				55.75	56.65
				58.25	
				54.75	
	Kumbetarinemalli	87	47	48.25	
				41.	45.08
				46.	
Thittamalli Station....	Shennimalli Station ..	50	43	45.37	
				45.5	
				47.62	46.4
				47.88	
				45.63	
Kumbetarinemalli	Thittamalli Station....	37	3	61.85	
				54.6	58.68
				59.6	
Thittamalli Station....	Yaelmatoor Station....	80	20	42.87	
				42.63	
				42.37	43.07
				43.63	
Paulamalli Station	Kumbetarinemalli	86	4	25.5	
				25.	23.5
				22.	
				21.5	

At Paulamalli Station.

		°	′	″	″ (mean)
Kumbetarinemalli Station	Woorachmalli Station	65	49	1.	
				0.75	2.12
				4.5	
				2.25	
Ponnassmalli Station....	Kumbetarinemalli ..	91	22	1.5	2.12
				2.75	

At Kumbetarinemalli Station.

		°	′	″	″ (mean)
Ponnassmalli Station ..	Paulamalli Station	43	48	33.25	
				35.25	
				34.75	34.15
				35.25	
				32.25	

At Kumbetarinmalli Station (continued.)

BETWEEN	AND	° ′ ″		
Woorachmalli Station..	Paulamalli Station....	28 6	38.75 39.25 38.75 37.5 35.	37.85
	Thittamalli Station....	55 32	23.58 21.57	22.57

At Ponnassmalli Station.

Kumbetarinemalli Station	Paulamalli Station ..	44 49	36.04 35.04 33.04	34.71

PRINCIPAL TRIANGLES.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Hallagamalli from Yaelmatoor 130600.5 feet.						
		° ′ ″	″			° ′ ″	
1	Hallagamalli Station ..	72 11 51.25	−1.4			72 11 49.5	
	Yaelmatoor Station ..	51 55 11.37	−1.11			51 55 09.75	
	Thittamalli Station....	55 53 02.25	−1.14			55 53 00.75	
		180 00 04.87		3.65″	+ 1.22″	180 00 00.00	
	Thittamalli from { Hallagamalli Station						124171.3
	Thittamalli from { Yaelmatoor Station............						150195.2
	Hallagamalli from Shennimalli Station 74520.2 feet.						
2	Hallagamalli Station ..	59 21 00.31	−0.54			59 20 59.75	
	Shennimalli Station ..	84 00 15.56	−0.84			84 00 14.5	
	Thittamalli Station....	36 38 46.37	−0.50			36 38 45.75	
		180 00 02.24		1.88	+ 0.36	180 00 00.0	
	Thittamalli from { Hallagamalli Station						124168.7
	Thittamalli from { Shennimalli Station............						107409.5

The above Base will be found in the commencement of this volume, in the 7th triangle.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Shennimalli from Yaelmatoor, 60265.1 feet.						
		° ′ ″	″			° ′ ″	
3	Shennimalli Station ..	56 51 35.75	—0.32			56 51 35.4	
	Yaelmatoor Station ..	93 31 34.37	—0.78			93 31 33.6	
	Woorachmalli........	29 36 56.65	—0.35			29 36 51.	
		180 00 06.77		″ 1.45	″ + 5.32	180 00 00.0	
	Woorachmalli from { Shennimalli Station..........						121724.6
	Yaelmatoor Station..........						102117.6
	This Base is in the 9th triangle of the same Researches.						
	Shennimalli from Thittamalli Station, 107409.5 feet.						
4	Shennimalli Station ..	. . .				67 56 51.8	
	Thittamalli Station	61 19 23.66	—0.95			61 19 22.7	
	Woorachmalli Station..	50 43 46.4	—0.87			50 43 45.5	
						180 00 00.0	
	Woorachmalli Station from { Shennimalli Station........						121724.2
	Thittamalli Station........						128592.3
	Shennimalli Station from Woorachmalli, 121724.6 feet.						
5	Shennimalli Station......	. . .				67 56 51.8	
	Woorachmalli Station..	50 43 46.4	—0.87			50 43 45.5	
	Thittamalli Station....	61 19 23.66	—0.95			61 19 22.7	
						180 00 00.0	
	Thittamalli Station from { Shennimalli Station						107409.9
	Woorachmalli Station						128592.3
	Yaelmatoor from Thittamalli Station, 150195.2 feet.						
6	Yaelmatoor Station ..	. . .				57 34 11.75	
	Thittamalli Station....	42 05 07.4	—0.84			42 05 06.5	
	Woorachmalli Station	80 20 43.07	—1.31			80 20 41.75	
						180 00 00.0	
	Woorachmalli from { Yaelmatoor Station						102112.3
	Thittamalli Station..........						128593.3

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Thittamalli from Woorachmalli Station, 128592.8 feet.						
		° ′ ″	″			° ′ ″	
7	ThittamalliStation....	87 23 43.7	−1.36			87 23 41.75	
	Woorachmalli Station	37 03 58.68	−0.73			37 03 57.25	
	Kumbetarinemalli	55 32 22.57	−0.76			55 32 21.00	
		180 00 04.95		2.85	+2.1	180 00 00.00	
	Kumbetarinemalli Station from { Thittamalli Station						94003.4
	Woorachmalli Station....						15580.9
	The above Base is the mean distance found in the three triangles on the following different Bases, viz., *Shennimalli* from *Thittamalli*, *Shennimalli* from *Woorachmalli*, and *Yaelmatoor* hill from *Thittamalli* station; differing in the extremes only one foot.						
	Shennimalli from Woorachmalli 121724.4 feet.						
8	Shennimalli Station ..	53 22 29.08	−1.14			53 22 28.	
	Woorachmalli Station	87 47 45.08	−2.16			87 47 43.	
	Kumbetarinemalli	. . .				38 49 49.	
						180 00 00.	
	Kumbetarinemalli from { Shennimalli						193989.1
	Woorachmalli						155801.6
	The side Shennimalli from Woorachmalli is the mean distance found in the triangles Shennimalli, Yaelmatoor hill, Woorachmalli; and Shennimalli, Thittamalli, Woorachmalli.—						
	Woorachmalli from Kumbetarinemalli, 155801.6 feet.						
9	Woorachmalli Station	86 04 23.5	−0.75			86 04 22.	
	Kumbetarine Station..	28 06 37.85	−1.36			28 06 37.	
	Paulamalli Station....	65 49 02.12	−0.84			65 49 01.	
		180 00 03.47		2.95	+0.52	180 00 00.	
	Paulamalli from { Woorachmalli						80470.9
	Kumbetarinemalli						170388.5
	Kumbetarine from Paulamalli, 170388.5 feet.						
10	Kumbetarinemalli	43 48 34.15	−1.63			43 48 32.5	
	Paulamalli Station	91 22 02.12	−3.45			91 21 54.5	
	Ponnassmalli Station ..	44 49 34.71	−1.66			44 49 33.0	
		180 00 10.98		6.74	+4.24	180 00 00.0	
	Ponnassmalli Station from { Kumbetarinemalli						241632.9
	Paulamalli Station						167319.6

DESCRIPTION OF THE GREAT STATIONS.

Hallagamalli. A hill with a pagoda on the top, about seven miles S. W. from *Shennimalli.* The station is on the platform of the pagoda.

Shennimalli. A hill near a respectable village of that name on the great road from *Eerode* to *Daraporam.* The station is on the highest part of the hill, a few hundred feet N. W. from the pagoda. It is marked as usual with a platform and stone.

Yáëlmatoor. A well-known hill about six miles E. N.E. from *Shennimalli,* with a pagoda near the top. The station is on a stone platform a little way to the N. W. of the pagoda, on the highest part of the hill.

Thittamalli. A small hill with a pagoda near the top, and lies about thirteen miles S. easterly from Sattimungalum. The station is on a rock, above where the pagoda stands, and a little way north from it.

Woorachmalli. A peaked hill about two miles N. E. from *Bhavany,* on the west bank of the *Cauvery.* The station is on the platform of the pagoda, on the top of the hill.

Paulamalli.—A very large mountain below the ghauts, in the northern district of *Coimbetoor.* The *Cauvery* river runs a little way to the westward of it. This mountain is well known, and is a few miles northerly from *Bhavany,* where the collector resides. On the very summit there is a pagoda, and the station is on the platform of that pagoda marked.

Kumbetarinemalli.—Another prodigious mountain in the northern district of *Coimbetoor*, about seven miles northerly from *Sattimungalum.* The mountain is well known there, and the road ascends from that side. The station is on the top of the peak, near a small pillar and a place of worship. It is in the middle of a platform built of mud and stones.

Ponnassmalli.—A great mountain well known in that part of the country. It has a double top, but the station is on the northernmost one, and cannot be mistaken. It is on a platform, with a marked stone in the middle. *Allambaddy* lies about seven miles east from this mountain.

Triangles taken up at the Base near Bangalore, and continued back to Ponnassmalli and Kumbetarine.

ANGLES.

At the N. end of the Base (near Bangalore).

BETWEEN	AND	°	′	″	″
S. end of the Base	Muntapum Station....	89	19	21.5	20.75
				19.75	
				20.25	
				21.5	

At the S. end of the Base.

N. end of the Base....	Muntapum Station....	33	43	60.4	60.06
				58.15	
				61.27	
				60.43	
Muntapum Station....	Bonnairgottah Station	106	09	36.25	37.72
				39.76	
				36.5	
				38.38	

At the Muntapum Station.

BETWEEN	AND	°	′	″	Mean ″
N. end of the Base....	S. end of the Base	56	56	40.62	41.42
				41.4	
				42.25	
S. end of the Base....	Bonnairgottah Station..	35	3	56.05	56.05
				54.75	
				54.25	
				57.75	
				57.5	
Bonnairgottah Station..	Tirtapully Station	97	26	51.53	53.39
				55.25	

At the Muntapum Centre.

BETWEEN	AND	°	′	″	Mean ″
Bonnairgottah Station..	Tirtapully Station	97	28	55.75	55.27
				54.85	
				55.	
				55.5	
	Savendroog Station....	69	50	45.25	46.5
				47.75	

At Dodagoontah Station.

BETWEEN	AND	°	′	″	Mean ″
Savendroog Station....	Bonnairgottah Station..	61	34	54.	51.29
				50.	
				49.	
				55.	
				50.	
Referring Flag	Savendroog Station ..	104	4	29.5	29.68
				31.25	
				29.	
				27.3	
				32.5	
				28.5	
Referring Lamp	Pole Stars W. elong. 19th	1	31	53.	
	1805, July 22d......			56.25	
	8th			51.25	
	12th			48.5	
	17th			46.25	
	18th			47.5	
	19th			45.5	
	23d			45.5	
	26th			43.5	
	26th			44.5	

At Bonnairgottah Station.

BETWEEN	AND	°	′	″	
S. end of the Base	Muntapum Station	38	46	30.02 32.28	31.15
Muntapum Station....	Tirtapully Station	51	7	53.25 53.6 57.	54.62
Tirtapully Station	Muntapum Station	51	5	56.65 56.55 59.55 54.9	56.91
Muntapum Station....	Savendroog Station....	70	52	25.06 22.77	23.91
Dodagoontah Station ..	Savendroog Station....	83	20	14.75 17.5 16.25	16.17

At Tirtapully Station.

Muntapum Station....	Bonnairgottah Station..	31	25	15.03 17.27	16.15
Muntapum Centre....	Bonnairgottah Station..	31	25	7.97 9.95	8.96
Deorabetta Station....	Savendroog Station....	46	42	26.25 22.75	24.5

At Deorabetta Station.

Savendroog Station....	Tirtapully Station	79	40	54. 52. 53. 52.75 52.75	52.9
Savendroog Station....	Bundhullydroog	97	47	58.5 58.25 56.5	57.75
Bundhullydroog	Ponnassmalli Station ..	36	19	24. 24. 23.	23.33

At Savendroog Station.

BETWEEN	AND	°	′	″	Mean ″
Muntapum Centre	Bonnairgottah Station..	39	16	50.25	
				50.75	
				50.25	50.88
				51.25	
				51.75	
				51.05	
Tirtapully Station	Deorabetta Station	53	36	48.	
				48.	47.5
				47.25	
				46.75	
Deorabetta Station	Bundhullydroog Station	41	41	41.25	
				40.5	
				40.75	
				41.5	40.93
				40.25	
				41.75	
				40.5	

At Bundhullydroog Station.

BETWEEN	AND	°	′	″	Mean ″
Savendroog Station....	Deorabetta Station	37	70	28.5	30.12
				31.75	
Deorabetta Station	Ponnassmalli Station ..	66	43	2.75	
				3.25	3.25
				3.	
				4.	
Ponnassmalli Station ..	Kumbetarinemalli	85	12	57.19	
				54.7	
				55.94	55.4
				53.95	
				55.2	

At Ponnassmalli Station.

BETWEEN	AND	°	′	″	Mean ″
Deorabetta Station....	Bundhully Station	76	57	35.	
				34.25	34.5
				34.25	
Bundhully Station....	Kumbetarinemalli	67	12	36.75	
				36.75	
				37.5	
				35.25	35.96
				33.25	
				36.25	

At Kumbetarinemalli Station.

BETWEEN	AND			
Bundhullydroog......	Ponnassmalli Station	27° 34′ 34″.		
		36.		
		34.25		
		35.5	}	35″.96
		37.		
		37.5		
		37.5		

PRINCIPAL TRIANGLES.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	N. end of the base from S. end of the base 39793.7 feet.						
		° ′ ″	″			° ′ ″	
11	N. end of the base....	89 19 20.75	—0.12			89 19 20	
	S. end of the base	33 44 00.06	—0.06			33 43 5 93	
	Muntapum Station....	56 56 41.42	—0.06			56 56 40.7	
		180 00 02.23		″ 0.24	′ +1.99	180 00.00 0	
	Muntapum station from { N. end of the base						26365.95
	S. end of the base						47475.03
	S. end of the base from Muntapum Station 47475.03 feet.						
12	S. end of the base	106 09 37.72	—0.3			106 09 35.9	
	Muntapum Station....	35 03 56.05	—0.08			35 03 54.5	
	Bonnairgottah Station	38 46 31.15	—0.07			38 46 29.6	
		180 00 04.92		0.47	+1.45	180 00 00.0	
	Bonnairgottah station from { S. end of the base......						43551.7
	Muntapum Station						72811.7
	Muntapum Station from Bonnairgottah Station 72811.7 feet.						
13	Muntapum Station....	97 26 53.39	—1.07			97 26 53.9	
	Bonnairgottah Station	51 07 54.62	—0.37			51 07 51.2	
	Tirtapully hill Station	31 25 16.15	—0.41			31 25 11.9	
		80 00 04.16		1.85	+2.31	180 00 00.0	
	Tirtapully Station from { Muntapum Station						108746.8
	Bonnairgottah Station						138492.2

Bonnairgottah Station from Tirtapully Station 138492.9 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″				
14	Bonnairgottah Station	51 05 56.91	—0.4			51 05 56.5	
	Tirtapully Station	31 25 08.96	—0.4			31 25 09	
	Muntapum Centre....	97 28 55.27	—1.1			97 28 54.5	
		180 00 01.14		1.9	—0.76	180 00 00.0	
	Muntapum centre from { Bonnairgottah Station						72815.6
	Muntapum centre from { Tirtapully Station						108705.1

Muntapum Centre from Bonnairgottah 72815.6 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
			″				
15	Muntapum Centre....	69 50 46.5	—0.6			69 50 46	
	Bonnairgottah Station	70 52 23.91	—0.6			70 52 28.5	
	Savendroog Station ..	39 16 50.88	—0.5			39 16 50.5	
		180 00 01.29		1.7	—04.1	180 00 00.00	
	Savendroog Station from { Muntapum Centre						108661.6
	Savendroog Station from { Bonnairgottah Station ..						107968.7

Bonnairgottah from Savendroog Station 107968.7 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
16	Bonnairgottah Station	83 20 16.17	—0.79			83 20 15.4	
	Savendroog Station ..	. . .				35 04 53.8	
	Dodagoontah Station..	61 34 51.29	—0.52			61 34 50.8	
						180 00 00.0	
	Dodagoontah Station from { Bonnairgottah........						70556.7
	Dodagoontah Station from { Savendroog Station....						121933.2

With the sides *Muntapum* Centre from *Tirtapully* hill 108705.1 feet, and *Muntapum* Centre from *Savendroog* 108661.6 feet, and the included angle at *Muntapum* Centre 167° 19′ 29″.3, the side *Savendroog* Station from *Tirtapully* Hill is found 216038.9 feet.

Again, with the sides *Bonnairgottah* from *Tirtapully* 138492.9 feet, and *Bonnairgottah* from *Savendroog* 107968.7 feet, and the included angle at *Bonnairgottah* 121° 58′ 19″, the side *Savendroog* from *Tirtapully* is found 216038.8 feet, differing from the above $\frac{1}{10}$ of a foot, and of which the mean is 216038.85 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Savendroog from Tirtapully Station 216038.85 feet.						
17	Savendroog Station ..	53 36 47.5	—1.9			35 36 45.5	
	Tirtapully Station	46 42 24.5	—1.9			46 42 22.5	
	Deorabetta Station ..	79 40 52.9	—2.8			79 40 52	
		180 00 04.9		6.6	—1.7	180 00 00.0	
	Deorabetta Station from { Savendroog Station......						159828.8
	Deorabetta Station from { Tirtapully Station						176775.8
	Savendroog Station from Deorabetta 159828.8 feet.						
18	Savendroog Station ..	44 41 40.93	—1.4			44 41 39.5	
	Deorabetta Station ..	97 47 57.75	—4			97 47 52	
	Bundhullydroog Station	37 30 30.12	—1.5			37 30 28.5	
		180 00 08.8		″ 6.9	″ 1.9	180 00 00.0	
	Bundhullydroog from { Savendroog Station........						260072
	Bundhullydroog from { Deorabetta Station						184620.5
	Deorabetta Station from Bundhullydroog 184620.5 feet.						
19	Deorabetta Station ..	36 19 23.33	—1.25			36 19 22	
	Bundhully Station	66 43 03.25	—1.47			66 43 03.5	
	Ponnassmalli Station ..	76 57 34.5	—1.78			76 57 34.5	
		180 00 01.08		4.5	+ 3.42	180 00 00.0	
	Ponnassmalli Station from { Deorabetta Station....						174071.7
	Ponnassmalli Station from { Bundhullydroog						112251.8
	Bundhullydroog from Ponnassmalli 112251.8 feet.						
20	Bundhullydroog Station	85 12 55.4	—2.66			85 12 52.5	
	Ponnassmalli Station ..	67 12 35.96	—1.71			67 12 33.5	
	Kumbetarinemalli Stat.	27 34 35.96	—1.54			27 34 34	
		180 00 07.32		5.91	+ 1.41	180 00 00.0	
	Kumbetarinemalli from { Bundhully Station						223551.4
	Kumbetarinemalli from { Ponnassmalli Station......						241637.7

Here appears a difference of $4\frac{8}{10}$ feet in the distance from *Ponnassmalli* to *Kumbetarine* hill, as given by the triangle, from whence it may be inferred, that, had the base been computed from bringing the triangles from the northward, it would have exceeded the measurement by $7\frac{7}{10}$ inches.

DESCRIPTION OF THE GREAT STATIONS.

N. and S. end of the base line, near *Bangalore*, are both defined by square masses of stone masonry, having each a circle and a point in the centre of the mass. The first is near the village of *Banswaddy*, nearly a quarter of a mile S. easterly from it. The second lies about half a mile S. easterly from a small village named *Agrarum*, which is upwards of three miles N. E. from *Beygoor*.

Muntapum Station. There are two stations made use of: the one is in the centre of the *Muntapum*; and the other a few feet to the west of it, but is now defaced. The *Muntapum* (a small *Hindoo* building on four pillars) lies about four miles north from *Bangalore*, a little way to the westward of the *Nundydroog* road. It is a noted object, and seen at a great distance.

Dodagoontah Station. This is the great station of observation at which the position of the meridian line is determined. It lies half way between the north end of the base and the *Muntapum*, and is marked by a large well-built stone platform of a circular form, and about ten feet in diameter. Its foundation is about two feet and a half under ground, having a large stone at the bottom, with a circle whose centre corresponds with the centre of the circle above, over which the plummet of the instrument was suspended during the observation.

Bonnairgottah Station. A small rocky hill close to the village of that name, lying about ten miles nearly south from *Bangalore*. The station is on a platform of clay on the top of the hill, with a marked stone in the middle.

Tirtapulli Station. A small hill, upwards of seven miles E. S. E. from the *Eedgah*, near *Ooscottah*. It is well known in that neighbourhood, and the station is on its summit, being a platform of clay and stones, with a marked stone in the middle. It is close to the road leading from *Ooscottah* to *Malloor*.

Deorabetta Station. This is a small hill upwards of seven miles south from *Annicul*, with a pagoda on the top. The station is on the platform of the pagoda, marked by a small millstone.

Savendroog Station. The station is on the summit of the east peak of the droog, about forty or fifty feet north easterly from the *Muntapum.* The circle is inserted on the rock.

Bundhullydroog or *Eekrumgherry Station.* This is a large mountain south of the *Cauvery* river, in the northern district of *Coimbetoor*, upwards of thirteen miles nearly east from *Sattiagul.* The station is on the platform of a small building on the highest pinnacle of the droog. There is another building close to it to the west. A circle is marked on the building, over which the instrument stood; but there was erected a pyramid of brick, several feet high, to serve as a mark to be taken from the other stations, and which may probably remain for many years. The village of *Bundhully* is a little way to the eastward.

Triangles taken up at Deorabetta and Savendroog, and continued to the side Paughur from Yerracondah.

ANGLES.

At Deorabetta Station.

BETWEEN	AND	° ′ ″		Mean ″
Savendroog Station....	Allasoor Station......	47 20	36.68	
			38.18	
			37.93	38.73
			38.93	
			41.93	

At Savendroog Station.

BETWEEN	AND	° ′ ″		
Deorabetta Station	....Allasoor hill	78 57	48. 48. 47.25 56.75	47.5
Allasoor hill Station	..Cheetkul hill Station ..	55 41	36. 35.5 33.25	34.92

At Allasoor Station.

Deorabetta Station	....Savendroog Station....	53 41	39.87 42. 37.75 38.75	39.59
Savendroog Station	,...Cheetkul Station......	62 10	44.5 44.75 41.87	43.71
Cheetkul Station......	Kulkotah Station	60 45	47.75 47.75 46.5 50.	48.

At Cheetkul Station.

Savendroog Station	..Allasoor hill Station ..	62 7	47.75 48.	47.87
Allasoor hill Station	..Kulkotah Station......	42 19	21.75 17.5	19.62
Kulkotah Station	....Bailippee Station	71 36	29.25 29. 26.75 27. 25.75	27.54

At Kulkotah Station.

Cheetkul hill Station	..Allasoor Station......	76 54	54.75 49.75 52.25 50.75 52.5	52.

At Kulkotah Station (continued.)

BETWEEN	AND	°	′	″	Mean ″
Cheetkul Hill	Bailippee Station	53	34	3.	3.7
				5.5	
				3.5	
				3.5	
				3.	
Bailippee Station	Yerracondah Station ..	59	20	36.25	37.1
				38.	
				37.25	
				36.5	
				37.5	

At Bailippee Station.

Kulkotah Station	Cheetkul Station......	54	49	32.75	35.12
				35.75	
				34.	
				38.	
	Yerracondah Station ..	72	20	57.5	57.5
				58.5	
				59.75	
				54.25	
Yerracondah Station ..	Paughur Station......	54	7	38.	39.56
				41.	
				39.75	
				39.5	

At Yerracondah Station.

Kulkotah Station	Bailippee Station	48	18	29.75	30.37
				31.25	
				30.12	
Bailippee Station	Paughurdroog Station..	63	20	45.5	45.15
				44.25	
				45.	
				44.25	
				46.75	

At Paughurdroog Station.

Yerracondah Station ..	Bailippee Station......	62	31	43.75	43.29
				44.5	
				43.75	
				41.75	
				43.75	
				42.25	

PRINCIPAL TRIANGLES.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Savendroog from Deorabetta Station 159828.8 feet.						
		° ′ ″	″			° ′ ″	
21	Savendroog Station....	78 57 47.5	−2.26			78 57 45.1	
	Deorabetta Station....	47 20 38.73	−1.55			47 20 37.	
	Allasoor Station	53 41 39.59	−1.69			53 41 37.9	
		180 00 05.82		″ 5.4	″ +0.42	180 00 00.0	
	Allasoor hill from { Savendroog Station............						145859.1
	Allasoor hill from { Deorabetta Station............						194662.8
	Savendroog from Allasoor hill 145859.1 feet.						
22	Savendroog Station ..	55 41 34.92	−1.3			55 41 32.8	
	Allasoor Station......	62 10 43.71	−1.4			62 10 41.5	
	Cheetkul Station......	62 07 47.87	−1.4			62 07 45.7	
		180 00 06.5		4.2	+2.3	180 00 00.0	
	Cheetkul Station from { Savendroog Station........						145924.8
	Cheetkul Station from { Allasoor Station						136292.3
	Allasoor hill from Cheetkul hill 136292.3 feet.						
23	Allasoor Station	60 45 48.	−0.8			60 45 48.2	
	Cheetkul Station	42 19 19.62	−0.8			42 19 19.8	
	Kulkotah Station	76 54 52.	−1.1			76 54 52.	
		179 59 59.62		2.6	−2.98	180 00 00.0	
	Kulkotah hill from { Allasoor Station						94211.8
	Kulkotah hill from { Cheetkul Station..............						122100.6
	Cheetkul hill from Kulkotah Station 122100.6 feet.						
24	Cheetkul Station	71 36 27.54	−1.2			71 36 25.3	
	Kulkotah Station	53 34 03.07	−1.0			53 34 01.7	
	Bailippee Station	54 49 35.12	−1.1			54 49 33.	
		180 00 06.36		3.3	+3.06	180 00 00.0	
	Bailippee Station from { Cheetkul Station.........						120180.9
	Bailippee Station from { Kulkotah Station						141745.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
Kulkotah Station from Bailippee Station 141745 feet.							
25	Kulkotah Station	° ′ ″ 59 20 37.1	″ −1.8			° ′ ″ 59 20 35.3	
	Bailippee Station	72 20 57.5	−1.8			72 20 55.7	
	Yerracondah Station ..	48 18 30.37	−1.6			48 18 29.	
		180 00 04.97		″ 5.2	″ −0.23	180 00 00.0	
	Yerracondah from { Kulkotah Station						180883.3
	Yerracondah from { Bailippee Station						163290.5
Bailippee Station from Yerracondah 163290.5 feet.							
26	Bailippee Station	54 7 39.56	−1.6			54 7 37.	
	Yerracondah Station ..	63 20 45.15	−1.8			63 20 42.5	
	Paughur Station......	62 31 43.29	−1.8			62 31 40.5	
		180 00 08.00		5.2	+2.8	180 00 00.0	
	Paughurdroog from { Bailippee Station						164484.9
	Paughurdroog from { Yerracondah Station						149134.2

DESCRIPTION OF THE GREAT STATIONS.

Allasoor Station.—A rocky hill close to the *Nundydroog* road, near twelve miles north from *Dodagoontah.* The station is on the highest part of the rock to the westward of a small hollow running across the top. The circle is on the rock.

Cheetkul Station.—It is a hill about a mile to the S. W. of a large village of that name, lying on the road from *B. Pallapoor* or *Davaroydroog.* The station is marked on the top of the rock. There is a very large stone close to the south of the rock.

Kulkotah Station.—A hill near a village of that name, near seven miles N. W. from *Nundydroog.* The station is on a platform at the summit, close to a high rock with

a pillar upon it to the S. E. of the platform. A stone with a circle defines the station.

Bailippee Station.—A hill in the jungle, upwards of five miles precisely east from *Mudgherry*. The station is on its summit marked as usual.

Yerracondah Station.—A hill in the ceded districts, about twelve miles S. S. E. from *Pencondah*. There is no village very near it, but it is well known; the station is on the highest part, and is on a large platform built of loose stones and mud, with a stone and circle in the middle. The ascent is on the east side.

Paughur Station. A large droog, well known on the northern boundary of *Mysoor*. The station is on a circular platform on the top of a square mass of building where the flag-staff stood, and is in the centre of the Sultan's battery, the largest circular fortified rock on the top of the droog. A circular stone with a hole in it defines the station.

Measurement of the Base Line near Gooty.

Experiments made for comparing the Chains.

PREVIOUS TO THE MEASUREMENT.				AFTER THE MEASUREMENT.		
MONTH.	Excess of the old Chain.		REMARKS.	MONTH.	Excess of the Old Chain	REMARKS.
1811.	A. M.	P. M.		1811.	A. M.	
	Divisions.	Divisions.			Divisions.	
April 10th,	31	30		May 11th,	38.25	
	30	30.5			37.5	
	30	30	Mean		38.5	
	30	30			39	Mean
	31	31	temperature		39	
	30	30			39	temperature
	31	31	during these		38.5	
	30	29.5	experiments,		38.5	during these
	31	30			39	experiments
	31.5	30	A. M. 81°.3		38	was 89°.6.
	31		P. M. 101.6		37	
	30.5				37	
	31					
Mean	30.62	30.2		Mean	38.27	

TABLE containing the Particulars of the Measurement.

[Commenced 12th April, 1811.]

No. of the Hypo-thenuse.	Length of each in Feet.	Angles of Elevation and Depression.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Tempe-rature.
				Ascents.	Descents.	Above.	Below.	
		° ′ ″	Feet.	Feet.	Feet.	Inches.	Inches.	°
1	1300	0 12 39	.00084		4.78	.30		98.2
2	700	0 2 42	.00021		0.55		9.8	88.
3	900	0 22 33	.01935		5.90		10.8	103.7
4	1100	0 30 57	.04466		9.90		12.3	89.6
5	800	0 15 54	.00856		3.70			96.
6	500	0 14 00	.00415		2.04		10.8	101.4
7	400	0 5 37	.00052	0.65		15.2		80.2
8	800	0 2 15	.00016		0.52	9.		95.2
9	800	0 5 00	.00088		1.16			100.8
10	900	0 23 09	.02043		6.06		10.5	92.1
11	600	0 09 09	.00210		6.60		5.7	107.1
12	700	0 31 45	.02986		1.47		16.1	83.3
13	800	0 30 00	.03048		6.98		13.	104.7
14	400	0 28 57	.01420		3.37		8.5	114.5
15	700	0 34 12	.03465		6.96			81.5
16	700	0 23 06	.01582		4.70		1.5	95.7
17	900	0 23 57	.02187		6.27		4.5	92.1
18	900	0 25 15	.02421		6.61	15.5		96.6
19	800	0 21 03	.01504		4.90	5.		98.8
20	900	0 15 57	.00963		4.18		4.6	89.1
21	800	0 14 12	.00680		3.30		3.7	98.1
22	900	0 12 30	.00603		3.27		2.2	90.1
23	700	0 01 15	.00004	0.25			4.5	110.8
24	700	0 19 15	.01099		3.92			89.2
25	900	0 10 55	.00450		2.86	5.7		96.4
26	900	0 08 06	.00252		2.12		4.2	100.9
27	800	0 07 00	.00168		1.63		12.1	88.2
28	1000	0 13 22	.00760		3.89	2.2		110.3
29	600	0 16 27	.00684		2.87		5.3	89.3
30	900	0 23 54	.02178		6.26		10.7	106.1
31	800	0 17 49	.01072		4.15	14.		92.5
32	700	0 00 45			0.15	8.3		107.1
33	700	0 Level.					3.2	99.8
34	1600	0 12 44	.01104	5.93			5.8	104.9
35	800	0 01 08	.00002		0.26		8.5	103.5
36	600	0 08 33	.00186		1.49	1.8		104.9
37	1300	0 13 27	.01001		5.09		5.7	108.9
38	900	0 17 12	.01125		4.50		13.0	81.8
39	200	0 01 35	.00002	0.09				99.7
40	700	0 17 24	.00896		3.54		18.7	110.8
41	500	0 20 00	.00845		2.91		6.5	80.4
Descent from the termination of the Base to the ground..							27.0	
Total	32600		.43673	6.92	138.6	106.7	239.2	97.13

[Completed 4th May, 1811.]

N. end of the Base above S. end of the Base in perpendicular height 142.98 feet.

	FEET.
At the commencement, the old chain exceeded the new one 30.41 divisions of the micrometer, equal to .01218 feet. Therefore 326×100.01218 feet, will be the measure in terms of the new chain. .	=32603.9707
At the conclusion, the old chain exceeded the new one 38.27 divisions of the micrometer, and had therefore increased 7.86 divisions, equal to .00315 feet. Hence $326 \times \frac{0.00315}{2} = 0.5133$ feet, the correction for the wear, which add. .	+ 0.5133
The sum of the deductions from col. 4th is 0.43673 feet, which being increased in the ratio of 100.01218 feet, will be 0.43678, which subtract	— 0,4368
Hence the apparent horizontal distance will be	32604.0472
The correction for the expansion and reduced to the standard temperature of 62° will be $\frac{(97^\circ.13-50)\times.0074-(62^\circ-50^\circ)\times.01237}{12}$ $\times$ 32604.0472. will be 5.4429 feet, which add.	+ 5.4429
Hence the corrected measure of the base for the temperature of 62° will be. .	32609.4901
Which being reduced to the level of the sea by taking the mean height of the base, and which is 1181.5 feet above the level of the sea will be	32607.6000

Triangles taken up at the Base near Gooty, and continued back to the side Paughurdroog from Yerracondah.

ANGLES.

At the N. end of the Base.

BETWEEN	AND	°	′	″	Mean ″
Gootydroog Station ..	S. end of the Base	87	27	16.5	16.45
				21.5	
				20.5	
				17.	
				15.	
				16.5	
				15.	
				14.	
				13.5	
				15.	
S. end of the Base	Paumdy Station	35	04	8.	5.9
				7.	
				7.5	
				4.	
				3.	

At the S. end of the Base.

BETWEEN	AND	°	′	″	Mean ″
Gootydroog Station ..	N. end of the Base	27	13	59.	62.64
				67.5	
				69.	
				70.5	
				58.5	
				64.5	
				65.5	
				64.	
				55.5	
				56.5	
				58.5	
N. end of the Base	Paumdy Station	105	2	69.5	65.19
				56.5	
				64.	
				65.5	
				62.5	
				69.	
				68.5	
				66.	

At the S. end of the Base (continued).

BETWEEN	AND	°	′	″
Gootydroog Station	..Namthabad Station ..	27	14	2.64
Namthabad Station	..Paumdy Station	105	03	5.19
∠. N. end of the Base	Paumdy Station	105	3	05.19
∠. Gootydroog Station	N. end of the Base ..	27	14	02.64
∠. Paumdy Station	..Gootydroog Station ..	132	17	07.83

At Paumdy Station.

		°	′	″	Mean ″
N. end of the Base....	S. end of the Base	39	52	50.5	49.75
				49.	
				49.	
				50.	
				50.	
				50.	
Namthabad Station	..N. end of the Base	0	28	53.5	54.
				53.5	
				55.5	
				54.	
				53.5	
Gootydroog Station	..S. end of the Base	26	26	19.	19.69
				20.5	
				18.5	
				20.	
				21.5	
				21.5	
				18.5	
				18.	
Konakoondloo Station	Gootydroog Station ..	78	44	50.	51.61
				52.5	
				50.5	
				52.	
				52.5	
				52.	
				52.	
				51.	
				51.5	

BETWEEN	AND	° ′ ″		
Gootydroog Station	..Guddakulgooda Station	88 42	29.	29.35
			29.	
			27.5	
			25.	
			27.5	
			28.5	
			29.5	
			25.	
			35.	
			37.5	
N. end of the Base....	Namthabad Station....	0 28	54.	
	S. end of the Base	39 52	49.5	
S. end of the Base	Namthabad Station....	40 21	43.5	

At Konakoondloo Station.

Gootydroog Station	..Koelacondah Station ..	41 26	16.	18.57
			18.	
			16.	
			20.	
			21.	
			21.	
			18.	
Paumdy Station	Gootydroog Station....	36 01	43.	41.58
			39.5	
			43.	
			36.5	
			41.	
			46.5	

At Koelacondah Station.

Gootydroog Station	..Guddakulgooda Station	74 59	9.5	11.15
			8.	
			8.5	
			9.	
			7.5	
			9.5	
			7.5	
			18.	
			17.	
			17.	
Konakoondloo Station..	Gootydroog Station....	58 55	62.5	60.8
			56.5	
			64.	
			63.	
			58.	

At Guddakulgooda Station.

BETWEEN	AND	°	′	″	Mean
Gootydroog Station	..Ooderpudroog Station	69	26	22.5	21″.63
				27.5	
				24.	
				27.5	
				18.5	
				18.5	
				17.5	
				17.	
Paumdy Station	Gootydroog Station ..	24	14	38.5	36.17
				33.	
				35.	
				40.	
				37.	
				33.	

At Guddakulgooda Station.

BETWEEN	AND	°	′	″	Mean
Gootydroog Station	..Koelacondah Station ..	30	12	35.5	45.63
				34.	
				55.	
				47.5	
				54.	
				54.5	
				39.	
				45.5	

At Gootydroog Station.

BETWEEN	AND	°	′	″	Mean
N. end of the Base....	S. end of the Base	65	18	48.	41.19
				35.5	
				44.5	
				47.	
				47.	
				47.	
				38.	
				39.	
				33.	
				42.	
				32.	
Paumdy Station......	S. end of the Base	21	16	32.75	32.65
				37.	
				36.5	
				29.5	
				27.5	

At Gootydroog Station (continued).

BETWEEN	AND	°	′	″	Mean ″
N. end of the Base....	Namthabad Station ..	2	31	59.5	58.5
				57.	
				57.5	
				60.	
Paumdy Station......	Konakoondloo Station	65	13	28.5	27.83
				31.	
				26.	
				29.5	
				25.5	
				26.5	
Konakoondloo Station	Koelacondah	79	37	38.5	43.17
				48.5	
				40.5	
				45.5	
				43.5	
				42.5	
Koelacondah Station ..	Guddakulgooda	77	47	72.5	65.4
				64.	
				58.5	
				74.	
				58.	
Guddakulgooda Station	Paumdy Station	67	2	57.	56.17
				59.	
				52.5	
Ooderpudroog Station	Guddakulgooda	44	37	48.	48.9
				49.5	
				53.	
				46.5	
				52.	
				49.	
				41.5	
Davourcondah Station	Ooderpudroog Station	46	17	57.5	50.68
				58.	
				48.5	
				46.5	
				48.	
				50.5	
				50.5	
				50.5	
				48.5	
				52.	
				47.	
Namthabad	N. end of the base	2	31	58.5	
N. end of the base	S. end of the base	65	18	41.19	
S. end of the base	Namthabad.........	67	50	39.69	

At Ooderpudroog Station.

BETWEEN	AND	°	′	″	″
Guddakulgooda Station	Gootydroog Station....	65	55	49.	
				53.	
				50.	
				47.	
				46.	
				56.	53.3
				52.5	
				60.	
				60.5	
				59.	
Gootydroog Station	..Davurcondah	71	17	20.5	
				15.5	
				20.5	
				23.5	19.5
				24.5	
				15.5	
				16.5	
Davurcondah Station	..Condapilly Station	51	25	61.5	
				63.5	
				59.5	
				57.	64.5
				72.5	
				69.5	
				68.	

At Davurcondah Station.

BETWEEN	AND	°	′	″	″
Gootydroog Station	..Ooderpudroog Station..	62	24	54.5	
				52.5	
				53.	53.75
				55.	
				53.5	
				54.	
Ooderpudroog Station	Condapilly Station	59	4	11.5	
				18.	
				15.	
				18.	14.62
				15.5	
				11.	
				12.	
				16.	

At Davurcondah Station (continued).

BETWEEN	AND				
Condapilly Station....	Ooracondah Station	..53°	14′	42.5″	
				42.5	
				38.5	40.1″
				37.	
				40.	

At Condapilly Station.

Davurcondah Station..	Ooderpudroog Station	69	29	34.	
				37.	
				44.	
				47.5	43.14
				47.5	
				47.	
				45.	
Ooracondah Station ..	Davurcondah Station ..	84	41	16.	
				13.5	
				13.5	
				18.5	16.25
				19.	
				17.	
Paughurdroog Station	Ooracondah Station ..	52	40	2.	
				1.5	
				4.5	
				0.5	
				1.5	2.81
				4.5	
				2.5	
				5.5	

At Ooracondah Station.

Paughurdroog Station	Condapilly Station	79	34	36.5	
				36.	
				41.	38.17
				36.5	
				36.5	
				42.5	

At Ooracondah Station (continued).

BETWEEN	AND	°	′	″	Mean
Condapilly Station....	Davurcondah Station ..	42	3	73.5	64.81″
				72.	
				66.5	
				64.5	
				68.	
				57.	
				58.	
				59.	
Yerracondah Station ..	Paughurdroog Station..	70	58	32.	30.6
				30.	
				31.5	
				30.	
				29.5	

At Yerracondah Station.

Paughurdroog Station	Ooracondah Station ..	55	32	28.5	33.44
				33.	
				34.5	
				34.5	
				34.5	
				33.5	
				34.5	
				34.5	

At Paughurdroog Station.

Ooracondah Station ..	Yerracondah Station ..	53	28	59.	61.5
				62.5	
				60.	
				63.5	
				63.5	
				60.5	
Condapilly Station....	Ooracondah Station ..	47	45	22.5	21.7
				21.5	
				21.5	
				21.	
				22.	

PRINCIPAL TRIANGLES.

N. end of the base from S. end of the base 32067.6 feet.

Numbers.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
27	N. end of the base....	35 04 5.9	−0.03			35 04 5.7	
	S. end of the base	105 03 5.19	−0.15			105 3 4.8	
	Paumdy Station	39 52 49.75	−0.04			39 52 49.5	
		180 00 00.84		″ 0.22	″ +0.62	180 00 00.0	
	Paumdy Station from N. end of the base						49110.4
	Paumdy Station from S. end of the base						29218.8
28	N. end of the base	87 27 16.45	−0.07			87 27 16.3	
	S. end of the base	27 14 02.64	−0.03			27 14 2.6	
	Gootydroog Station ..	65 18 41.19	−0.03			65 18 41.1	
		180 00 00.28		0.13	+0.15	180 00 00.0	
	Gootydroog Station from N. end of the base						16423.3
	Gootydroog Station from S. end of the base						35852.7
	S. end of the base from Gootydroog Station 35852.7 feet.						
29	S. end of the base	132 17 7.83	−0.29			132 17 7.5	
	Gootydroog Station....	21 16 32.65	0.04			21 16 32.7	
	Paumdy Station	26 26 19.69	+0.06			26 26 19.8	
		180 00 00.17		0.19	−0.02	180 00 00.0	
	Paumdy Station from S. end of the base						29218.7
	Paumdy Station from Gootydroog Station						59571.8
30	S. end of the base	27 14 02.64	−0.03			27 14 2.61	
	Gootydroog Station ..	67 50 39.69	−0.04			67 50 39.65	
	Namthabad Station ..	. . .				84 55 17.74	
						180 00 00.0	
	Namthabad from S. end of the base						33336.3
	Namthabad from Gootydroog Station						16471.8

S. end of the base from Paumdy Station 29.218.8 feet.

Numbers.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
31	S. end of the base	132 17 7.83	—0.29			132 17 7.5	
	Paumdy Station	26 26 19.69	+0.06			26 26 19.8	
	Gootydroog Station ..	21 16 32.65	+0.04			21 16 32.7	
		180 00 00.17		″ 0 19	″ —0.02	180 00 00.0	
	Gootydroog Station from { S. end of the base						35852.9
	Paumdy Station						59572.7
32	S. end of the base	105 03 5.19	—0.15			105 03 5.04	
	Paumdy Station	40 21 43.5	—0.05			40 21 43.45	
	Namthabad Station ..	. . .				34 35 11.51	
		180 00 00.0				180 00 00.0	
	Namthabad from { S. end of the base						33334.9
	Paumdy Station						49707.4

Gootydroog Station from Paumdy Station 59.572 feet.

Numbers.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
33	Gootydroog Station ..	65 13 27.83	—0.41			65 13 27.5	
	Paumdy Station	78 44 51.61	—0.51			78 44 51.2	
	Konakoondloo Station	36 01 41.58	—0.36			36 01 41.3	
		180 00 01.02		1.28	—0.26	180 00 00.0	
	Konakoondloo from { Gootydroog Station..........						99334.6
	Paumdy Station						91959.1
34	Gootydroog Station ..	67 02 56.17	—0.50			67 02 55.7	
	Paumdy Station	88 42 29.35	—0.91			88 42 28.5	
	Guddakul Station	24 14 36.17	—0.48			24 14 35.8	
		180 00 01.69		1.89	—0.20	180 00 00.0	
	Guddakul Station from { Gootydroog Station........						145044.1
	Paumdy Station						133596.

The above base is a mean distance obtained by the 29th and 31st Triangles.

Numbers.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Gootydroog Station from Konakoondloo 99334.6 feet.						
		° ′ ″	″			° ′ ″	
35	Gootydroog Station ..	79 37 43.17	−0.75			79 37 42.2	
	Konakoondloo Station	41 26 18.57	−0.49			41 26 17.8	
	Koelacondah Station ..	58 56 00.8	−0.54			58 56 00.0	
		180 00 02.54		″ 1.78	″ +0.76	180 00 00.0	
	Koelacondah Station from { Gootydroog Station....						76749.2
	Koelacondah Station from { Konakoondloo Station						114073.3
	Gootydroog Station from Koelacondah 76749.2 feet.						
36	Gootydroog Station ..	77 48 5.4	−1.00			77 48 4.5	
	Koelacondah Station ..	71 59 11.15	−0.89			71 59 10.5	
	Guddakul Station	30 12 45.63	−0.69			30 12 45.	
		180 00 02.18		2.58	−0.40	180 00 00.0	
	Guddakulgooda Station from { Gootydroog Station						145043.5
	Guddakulgooda Station from { Konakoondloo Station ..						149075.9
	Gootydroog Station from Guddakulgooda 145043.8 feet.						
37	Gootydroog Station ..	44 37 48.5	−1.06			44 37 47.4	
	Guddakulgooda Station	69 26 21.63	−1.30			69 26 20.4	
	Ooderpeedroog Station	65 55 53.3	−1.24			65 55 52.1	
		180 00 03.43		3.60	−0.17	180 00 00.0	
	Ooderpeedroog Station from { Gootydroog Station						148736.1
	Ooderpeedroog Station from { Guddakulgooda Station ..						111599.7
	The distance from *Gootydroog* to *Guddakulgooda*, as a base in the above triangle, is a mean distance obtained by the 34th and 36th triangles.						
	Ooderpeedroog from Gootydroog Station 148736.1 feet.						
38	Ooderpeedroog Station	71 17 19.5	−1.52			71 17 18	
	Gootydroog Station ..	46 17 50.68	−1.20			46 17 49.5	
	Davurcondah Station ..	62 24 53.75	−1.34			62 24 52.5	
		180 00 03.93		4.06	−0.13	180 00 00.0	
	Davurcondah from { Ooderpeedroog Station						121317.2
	Davurcondah from { Gootydroog Station						158943.1

Numbers.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Davurcondah from Ooderpeedroog Station 121317.2 feet.						
		° ′ ″	″			° ′ ″	
39	Davarcondah Station..	59 4 14.62	−0.70			59 4 13.9	
	Ooderpeedroog Station	51 26 4.5	−0.87			51 26 3.8	
	Condapilly hill Station	69 29 43.14	−0.94			69 29 42.3	
		180 00 02.26		2.5	−0.24	180 00 00.0	
	Condapilly Station from Davurcondah Station						101273.8
	Condapilly Station from Ooderpudroog Station....						111105.4
	Davarcondah from Condapilly Station 101273.8 feet.						
40	Davurcondah Station ..	53 14 40.1	−0.80			53 14 39.9	
	Condapilly Station	84 41 16.25	−1.32			84 41 15.5	
	Ooracondah Station ..	42 4 4.81	−0.78			42 04 4.6	
		180 00 01.16		2.29	−1.74	180 00 00.0	
	Ooracondah Station from Davarcondah Station						150503.1
	Ooracondah Station from Condapilly Station						121102.6
	Condapilly Station from Ooracondah Station 121102.6 feet.						
41	Condapilly Station	52 40 02.81	−1.07			52 40 21	
	Ooracondah Station ..	79 34 38.17	−1.56			79 34 36.9	
	Paughurdroog Station	47 45 21.7	−1.05			47 45 21	
		180 00 02.68		3.68	−1.0	180 00 00.0	
	Paughurdroog from Condapilly Station						160889.4
	Paughurdroog from Ooracondah Station						130073.9
	Paughurdroog from Ooracondah Station 130073.9 feet.						
42	Paughurdroog Station	53 29 01.5	−1.4			53 28 59.75	
	Ooracondah Station ..	70 58 30.6	−1.14			70 58 28.6	
	Yerracondah Station ..	55 32 33.44	−1.16			55 32 31.65	
		180 00 05.54		3.70	+1.84	180 00 00.0	
	Yerracondah Station from Paughurdroog Station						126783.3
	Yerracondah Station from Ooracondah Station ..						149135.4

The distance from *Paughurdroog* to *Yerracondah* will be found common; by referring to the 26th triangle, it will appear that there is a difference of $1\frac{2}{10}$ feet in the same side *Paughurdroog* from *Yerracondah*, from whence it may be inferred that had the base been computed from bringing the triangles from the southward, it would fall short of the measurement by $3\frac{6}{10}$ inches.

For the purpose of reducing the terestrial arc, the following angles, with their including sides, have been used to obtain sides more conveniently situated with the meridian of *Dodagoontah* station, to which the whole arc is reduced.

The angle at *Bonnairgottah*, between *Dodagoontah* and *Deorabetta*, with the including sides, from which the angle at *Dodagoontah* station between *Bonnairgottah* and *Deorabetta* is found 14° 48′ 36″.6; and also the direct distance from *Dodagoontah* to *Deorabetta* is 135931.3 feet. The angle at *Dodagoontah* station is then corrected, to make it as an observed angle, which becomes 14° 48′ 35″.77.

DESCRIPTION OF THE GREAT STATIONS.

Base near Gooty.—N. end;—In the flat cotton ground about three miles west from *Gooty*, and near the village of *Namthabad.* It is situated on a rising ground marked by a circular platform of brick and chunam, with a stone and circle, the centre of which ascertains the extremity of the base.

S. end—Lies nearly a mile north of the village of *Eeranapully*, and is similarly marked with the former one. Under the masonry of both these platforms the extremities of the base are also defined by stones with

circles, fixed when the foundation was laid, and corresponding with those above.

Namthabad Station—Lies about seven hundred and twenty-five feet nearly North from the North end of the base, being exactly in the same line with the extremities of the base, and marked in the very same manner, to define the station.

Paumdy Station.—A long hill, running nearly east and west, and about two miles north of the village of *Paumdy* and the *Pinna* river. The station is on a platform, and the centre is marked as usual.

Konakoondloo Hill.—This hill is about a mile N. W. of the large hill of *Pullycondah,* and about two miles south of the great road from *Gooty* to *Ballary,* a village of the same name, situated at its south side. The station is on an old bastion, marked by a stone and circle.

Guddakulgooda Pagoda.—On the platform of the pagoda, marked as usual. The village and hill are well known, being about half the distance between *Gooty* and *Ballary.*

Koolacondah.—This hill is about fourteen miles north from *Gooty* in the *Chinumpully* talook, and two miles from the village of that name. On the summit of a large detached stone, marked as usual.

Gootydroog.—On the highest point of that celebrated droog. While observing, the flag-staff was removed. It was afterwards replaced, and marks the station.

Ooderpeedroog.—A small well-known hill fort on the road from *Hundee Anantapoor* to *Ballary.* The station is on the centre of a square platform, marked by a stone and circle, about ten yards east of a ruined pagoda.

Davurcondah.—A small peaked hill, with a rugged summit, about three miles east of *Hundee Anantapoor*, on the great road to *Gooty*. A thin stone pillar, to which the flag bamboo was attached, was the intersected object. While the instrument was there this pillar was removed; its centre marked by a small mill-stone, over which it was again erected, and a small circular platform of stone and chunam built round it. The hill derives its name from a pagoda about thirty yards west of the summit.

Condapilly Hill.—It is on the summit of a considerable range running nearly north and south. It derives its name from a village of some extent about a mile N. W. of it. The place where the instrument stood is marked by a circle on the rock, and is a few feet from the stone pillar on the highest point of the hill.

Ooracondah.—This hill is on the northernmost of the *Pencondah* range, and west of the village of *Chinnakatapilly*, on the great road between *Gooty* and *Bangalore*. On the other side is a village called *Nammudtella*. The station is marked with a platform, a large stone, and a circle, over the centre of which the instrument was placed.

Pole Star Observations at Dodagoontah Station; and the Position of its Meridian.

1805. Month.	Apparent Polar Distance.	Latitude.	Azimuth.	Angle between the Pole Star and referring Lamp.	Angle between the North Pole and referring Lamp.
	° ′ ″		° ′ ″	° ′ ″	° ′ ″
July 19	1 43 58.2	13° 00′ 04″	1 46 42.16	1 31 53.	0 14 49.16
22	1 43 57.57		1 46 41.7	1 31 56.25	0 14 45.45
Aug. 8	1 43 54.07		1 46 38.1	1 31 51.25	0 14 46.85
12	1 43 53.05		1 46 37.06	1 31 48.5	0 14 48.56
17	1 43 51.7		1 46 35.67	1 31 46.25	0 14 49.42
18	1 43 51.44		1 46 35.4	1 31 47.5	0 14 47.9
19	1 43 51.16		1 46 35.1	1 31 45.5	0 14 49.6
23	1 43 50.04		1 46 33.97	1 31 45.5	0 14 48.47
26	1 43 49.09		1 46 32.99	1 31 43.5	0 14 49.49
27	1 43 48.83		1 46 32.73	1 31 44.5	0 14 48.23
Angle between the North Pole and referring Lamp..					0 14 48.31 N.E[ly].
Angle between the referring Lamp and *Savendroog*..					104 4 29.68
Angle between the North Pole and *Savendroog* Station					103 49 41.37 N.W[ly]

In this paper the latitude of *Dodagoontah*, which is the great station for fixing the position of the meridian line, is laid down by reducing the terrestrial arc between *Putchapolliam* and *Dodagoontah* to degrees and minutes, taking the mean degree as given by the observations at *Putchapolliam* and *Namthabad*, near *Gooty*, which is 60487.27 for latitude 13° 02′ 55″, not differing much from the latitude of *Dodagoontah*. This gives an arc of 2° 0′ 14″.72, which, added to the arc between *Punnae* and *Putchapolliam*, gives 4° 50′ 25″.26; and this, applied to the latitude of *Punnae*, viz., 8° 9′ 38″.39, gives 13° 00′ 03″.65 for the latitude of *Dodagoontah*. This latitude exceeds that determined in 1805 by 3″.74; therefore, if this quantity be added to 13° 4′ 8″.7, the deduced latitude of the observatory (*Asiatick* Researches, vol. 10th, page 374), we have 13° 4′ 12″.44, the latitude of the observatory, as corrected from the present operations.

Reduction of the Sides of the Meridional Triangles to the Meridian of Dodagoontah, for determining the Length of the Terrestrial Arcs.

The Length of the Arc comprehended by the Parallels of Dodagoontah Station, and the Station near Putchapolliam.

STATIONS AT	NAMES OF PLACES.	Bearings referred to the Meridian of Dodagoontah Station.	Distances.	Distances on the Perpendicular.	Distances on the Meridian.	Distances from Dodagoontah. Perpendicular.	Distances from Dodagoontah. Meridian.
		° ′ ″	Feet.	Feet.	Feet.	Feet.	Feet.
Dodagoontah	Deorabetta	0 13 08.43 S.E.	135931.3	519.6 E.	135930.3 S.	519.6 E.	135930.3 S.
Deorabetta	Ponnassmalli....	2 11 54.36 S.E.	174071.7	6677.6 E.	173947.6 S.	7197.2 E.	309877.9 S.
Ponnassmalli..........	Woorachmalli ..	3 49 54.39 S.E.	243502.4	16272.6 E	242958.2 S.	23469.8 E.	552836.1 S.
Woorachmalli	Putchapolliam ..	7 53 51.52 S.W.	176169.4	24206.4 W	174498.5 S.	736.6 W.	727334.6 S.

Distances between the Parallels of Dodagoontah and the Station at Namthabad.

STATIONS AT	NAMES OF PLACES.	Bearings referred to the Meridian of Dodagoontah Station.	Distances.	Distances on the		Distance from Dodagoontha.	
				Perpendicular.	Meridian.	Perpendicular.	Meridian.
		° ′ ″	Feet.	Feet.	Feet.	Feet.	Feet.
Deorabetta	Allasoor hill	0 43 54.55 N.W.	194662.8	2486.3 W.	194646.9 N.	1966.7 W.	58716.6 N.
Allasoor hill	Kulkotah hill ..	4 5 43.25 N.W.	94211.8	6728.3 W.	93971.2 N.	8695 W.	152687.8 N.
Kulkotah hill	Yerracondah....	5 43 49.55 N.E.	180883.8	18060.9 E.	179979.9 N.	9365.9 E.	332667.7 N.
Yerracondah	Ooracondah	7 4 21.49 N.W.	126783.3	15610.5 W.	125818.5 N.	6244.6 W.	458486.2 N.
Ooracondah	Davurcondah ..	5 32 52.09 N.E.	150503.3	14550.1 E.	149798.2 N	8305.5 E.	608284.4 N.
Davurcondah	Gootydroog	0 16 40.56 N.E.	158943.1	771 E.	158941.2 N.	9076.5 E.	767225.6 N.
Gootydroog	Namthabad	70 43 30.21 S.W.	16471.8	15548.5 W.	5437.3 S.	6472 W.	761788.3 N.

Terrestrial Arcs between the parallels of Dodagoontah Station and Namthabad..............	761788.3 feet.
Dodagoontah Station and Putchapolliam	727334.6
Putchapolliam Station and Namthabad	1489122.9
Putchapolliam Station and Punnae Station	1029100.5
Punnae Station and Namthabad	2518223.4

Zenith distances of Stars, observed at *Namthabad Station*, with the corrections for precession, nutation, aberration, and the semi-annual solar equation, back to the beginning of the year 1805.

Observations at Namthabad.

ο LEONIS.

Nearest Point on the Limb, 4° 20″ South.

1811. Month.	Face.	Observed Zenith Distance.	Correction.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	—	° ′ ″	°	°
April 18	W.	4 21 9.13	109.11	4 19 20.02	86	86
20	E.	4 21 19.53	109.00	4 19 30.53	83	83
21	W.	4 21 10.38	108.95	4 19 21.43	84	84
22	E.	4 21 18.26	108.90	4 19 29.36	87	87
24	W.	4 21 8.63	108.80	4 19 19.83	91	91
25	E.	4 21 20.13	108.74	4 19 31.39	92	92
26	W.	4 21 9.63	108.68	4 19 20.95	94	93
27	E.	4 21 19.13	108.63	4 19 30.50	96	96
28	W.	4 21 9.63	108.58	4 19 21.05	94	94
29	E.	4 21 19.26	108.52	4 19 30.74	93	93
30	W.	4 21 9.63	108.47	4 19 21.16	92	92
May 2	E.	4 21 19.38	108.36	4 19 31.02	78	79
				Mean	89.2	89.2

REGULUS.

Nearest Point on the Limb, 2° 15′ South.

1811. Month.	Face.	Observed Zenith Distance.	Correction.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
			—			
April 18	W.	2 12 47.51	115.48	2 10 52.03	86	86
20	E.	2 12 58.89	115.36	2 11 03.53	84	84
21	W.	2 12 45.76	115.29	2 10 50.47	83	83
22	E.	2 12 59.89	115.23	2 11 04.66	86	86
23	W.	2 12 44.76	115.16	2 10 49.60	83	83
24	E.	2 12 58.89	115.09	2 11 03.80	91	91
25	W.	2 12 44.87	115.03	2 10 49.84	91	91
26	E.	2 12 58.24	114.97	2 11 03.27	93	92
27	W.	2 12 44.74	114.90	2 10 49.84	95	94
28	E.	2 12 58.87	114.83	2 11 4.04	94	94
29	W.	2 12 46.87	114.77	2 10 52.10	93	93
30	E.	2 12 57.62	114.71	2 11 2.91	92	92
				Mean	89.25	89.08

ϑ LEONIS.

Nearest Point on the Limb, 1° 20′ North.

1811. Month.	Face.	Observed Zenith Distance.	Correction.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	+ ″	° ′ ″	°	°
April 20	E.	1 21 29.26	126.54	1 23 35.80	80	80
21	W.	1 21 40.26	126.45	1 23 46.71	82	82
22	E.	1 21 28.13	126.35	1 23 34.48	85	85
23	W.	1 21 40.13	126.26	1 23 46.39	82	81
24	E.	1 21 28.28	126. 6	1 23 34.44	89	89
25	W.	1 21 43.13	126.07	1 23 49.20	88	88
26	E.	1 21 30.13	125.98	1 22 36.11	91	91
27	W.	1 21 40.13	125.88	1 23 46.01	93	93
28	E.	1 21 29.63	125.79	1 23 35.42	93	93
29	W.	1 21 40.51	125.70	1 23 46.21	90	90
30	E.	1 21 29.13	125.60	1 23 34.73	90	90
May 4	W.	1 21 38.76	125.23	1 23 43.99	90	90
				Mean	87.75	87.67

β LEONIS.

Nearest Point on the Limb, 0° 30′ North.

			+			
April 18	W.	0 31 42.13	129.88	0 33 52.01	86	86
20	E.	0 31 33.76	129.68	0 33 43.44	79	79
21	W.	0 31 45.51	129.58	0 33 55.09	82	81
22	E.	0 31 33.63	129.47	0 33 43.10	84	84
23	W.	0 31 47.26	129.38	0 33 56.64	81	81
24	E.	0 31 31.38	129.28	0 33 40.66	87	87
25	W.	0 31 46.01	129.18	0 33 55.19	88	88
26	E.	0 31 33.03	129.07	0 33 42.10	90	90
27	W.	0 31 46.26	128.98	0 33 55.24	92	92
28	E.	0 31 35.13	128.88	0 33 44.01	92	92
29	W.	0 31 46.51	128.77	0 33 55.28	90	90
30	E.	0 31 33.13	128.66	0 33 41.79	90	90
				Mean	86.75	86.67

ε VIRGINIS.

Nearest Point on the Limb, 3° 5′ South.

1811. Month.		Face.	Observed Zenith Distance.			Correction.	Correct Zenith Distance.			Thermometers Upper.	Thermometers Lower.
			°	′	″	− ″	°	′	″	°	°
April	25	W.	3	7	9.13	124.85	3	5	4.28	87	86
	26	E.	3	7	23.39	124.75	3	5	18.64	90	90
	27	W.	3	7	12.13	124.65	3	5	7.48	90	90
	29	E.	3	7	20.26	124.44	3	5	15.82	88	88
	30	W.	3	7	13.01	124.34	3	5	8.67	88	88
May	3	E.	3	7	20.76	124.01	3	5	16.75	82	82
									Mean	87.5	87.33

δ SERPENTIS.

Nearest Point on the Limb, 3° 55′ South.

						−					
May	1	E.	3	55	15.13	77.56	3	53	57.57	81	81
	3	W	3	55	6.5	77.29	3	53	49.21	81	81
	4	E.	3	55	14	77.15	3	53	56.85	79	79
	5	W.	3	55	4	77.01	3	53	46.99	81	81
	7	E.	3	55	15.13	76.74	3	53	58.39	84	84
	9	W.	3	55	4.75	76.46	3	53	48.29	86	86
	15	E.	3	55	11.63	75.61	3	53	56.02	85	85
									Mean	82.13	82.13

γ SERPENTIS.

Nearest Point on the Limb, 1° 10′ North.

						+					
May	1	E.	1	11	10.63	67.83	1	12	18.46	81	81
	3	W.	1	11	17.51	67.51	1	12	25.02	81	81
	4	E.	1	11	11.88	67.35	1	12	19.23	78	78
	5	W.	1	11	19.76	67.18	1	12	26.49	81	81
	7	E.	1	11	10.38	66.85	1	12	17.23	84	84
	8	W.	1	11	21.01	66.69	1	12	27.70	86	86
	9	E.	1	11	10.63	66.52	1	12	17.15	86	86
	15	W.	1	11	21.13	65.48	1	12	26.61	84	84
									Mean	82.63	82.63

α HERCULIS.

Nearest Point on the Limb, 0° 30′ *South.*

1811. Month.		Face.	Observed Zenith Distance.	Correction.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
April	26	E.	0° 29′ 5.37″	27.69″	0° 28′ 37.68″	83°	83
	27	W.	0 28 55.4	27.55	0 28 27.85	83	83
	28	E.	0 29 3.87	27.40	0 28 36.47	83	83
	30	W.	0 28 57	27.09	0 28 29.91	82	82
May	1	E.	0 29 3.87	26.94	0 28 36.93	80	80
	2	W.	0 28 55.75	26.79	0 28 28.96	75	76
	3	E.	0 29 5	26.64	0 28 38.36	80	79
	4	W.	0 28 57.87	26.47	0 28 31.40	79	78
	5	E.	0 29 5	26.31	0 28 38.69	81	81
	7	W.	0 28 55.12	25.98	0 28 29.14	83	83
	8	E.	0 29 4.5	25.82	0 28 38.68	84	83
	9	W.	0 28 54.12	25.65	0 28 28.47	83	83
					Mean	81.33	81.17

α OPHIUCHI.

Nearest Point on the Limb, 2° 25′ *South.*

April	25	W.	2 23 18.37	18.55	2 22 59.82	82	81
	26	E.	2 23 30.87	18.42	2 23 12.45	83	83
	27	W.	2 23 21.99	18.28	2 23 3.71	83	83
	28	E.	2 23 33.87	18.14	2 23 15.73	83	83
	30	W.	2 23 22.74	17.86	2 23 4.88	82	82
May	1	E.	2 23 32.24	17.71	2 23 14.53	80	80
	2	W.	2 23 20.74	17.57	2 23 3.17	75	76
	3	E.	2 23 31.37	17.41	2 23 13.96	79	79
	4	W.	2 23 20.37	17.27	2 23 3.10	79	79
	5	E.	2 23 31.12	17.11	2 23 14.01	81	81
	7	W.	2 23 20.74	16.80	2 23 3.94	83	83
	8	E.	2 23 29.37	16.63	2 23 12.74	83	83
					Mean	81.09	81.09

ζ AQUILÆ.

Nearest Point on the Limb, 1° 30′ South.

1811. Month.	Face.	Observed Zenith Distance.	Correction.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	+ ″	° ′ ″	°	°
May 10	W.	1 30 15.5	31.48	1 30 46.98	82	82
14	E.	1 30 24.38	32.16	1 30 56.54	77	77
15	W.	1 30 16	32.30	1 30 48.30	82	82
				Mean	80.37	78.03

γ AQUILÆ.

Nearest Point on the Limb, 4° 55′ South.

			+			
May 1	E.	4 56 9.13	52.44	4 57 1.57	78	83
2	W.	4 55 58.63	52.57	4 56 51.20	76	76
4	E.	4 56 8.63	52.86	4 57 1.49	77	77
5	W.	4 56 2.63	53.00	4 56 55.63	80	80
7	E.	4 56 9.00	53.29	4 57 2.29	80	80
10	W.	4 55 59.13	53.75	4 56 52.88	80	80
11	E.	4 56 8.63	53.92	4 57 2.55	81	80
12	W.	4 55 59.63	54.07	4 56 53.70	84	83
15	E.	4 56 7.13	54.56	4 57 1.69	81	81
				Mean	79.67	80

ATAIR.

Nearest Point on the Limb, 6° 45′ South.

			+			
May 5	W.	6 42 57.24	58.02	6 43 55.26	80	80
7	E.	6 43 10.12	58.31	6 44 8.43	80	80
8	W.	6 42 57.74	58.46	6 43 56.20	80	80
9	E.	6 43 6.24	58.61	6 44 4.85	80	80
10	W.	6 42 54.87	58.76	6 43 53.63	79	79
11	E.	6 43 6.99	58.91	6 44 5.90	81	80
12	W.	6 42 54.25	59.08	6 43 53.33	84	83
15	E.	6 43 5.37	59.56	6 44 4.93	81	81
				Mean	80.63	80.37

β DELPHINI.

Nearest Point on the Limb, 1° 10′ South.

1811. Month.	Face.	Observed Zenith Distance.	Correction.	Correct Zenith Distance.	Thermometers Upper.	Thermometers Lower.
		° ′ ″	″ +	° ′ ″	°	°
May 9	E.	1 9 11.37	74.12	1 10 25.49	79	79
10	W.	1 9 1.87	74.27	1 10 16.14	79	79
12	E.	1 9 14	74.59	1 10 28.59	83	82
14	W.	1 9 4.62	74.91	1 10 19.53	77	77
11	E.	1 9 10.37	75.09	1 10 25.46	80	80
				Mean	79.6	79.4

Means of the Zenith Distances, taken on the right and left arcs corrected for refraction, equation of the sectorial tube, and the mean run of the micrometer.

Zenith Distances at Namthabad.

ο LEONIS.

1811.	Left Arc.	1811.	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
April 20	4 19 30.53	April 18	4 19 20.02	Mean	4 19 25.67
22	4 19 29.36	21	4 19 21.43	Refraction, &c. &c.	+ 4.24
25	4 19 31.39	24	4 19 19.83		
27	4 19 30.50	26	4 19 20.95	Zenith Distance ..	4 19 29.91
29	4 19 30.74	28	4 19 21.05		
May 2	4 19 31.02	30	4 19 21.16		
Mean	4 19 30.58	Mean	4 19 20.74		

REGULUS.

1811.	Left Arc.	1811.	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
April 20	2 11 3.53	April 18	2 10 52.03	Mean	2 10 57.18
22	2 11 4.66	21	2 10 50.47	Refraction, &c. &c.	+ 1.98
24	2 11 3.80	23	2 10 49.60		
26	2 11 3.27	25	2 10 49.84	Zenith Distance ..	2 10 59.16
28	2 11 4.04	27	2 10 49.84		
30	2 11 2.91	29	2. 10 52.10		
Mean	2 11 3.70	Mean	2 10 50.65		

ϑ LEONIS.

April 21	1 23 46.71	April 20	1 23 35.80	Mean	1 23 40.79
23	1 23 46.39	22	1 23 34.48	Refraction, &c. &c.	+ 1.29
25	1 23 49.20	24	1 23 34.44		
27	1 23 46.01	26	1 23 36.11	Zenith Distance ..	1 23 42.08
29	1 23 46.21	28	1 23 35.42		
May 4	1 23 43.99	30	1 23 34.73		
Mean	1 23 46.42	Mean	1 23 35.17		

β LEONIS.

April 18	0 33 52.01	April 20	0 33 43.44	Mean	0 33 48.72
21	0 33 55.09	22	0 33 43.10	Refraction, &c. &c.	+ 0.45
23	0 33 56.64	24	0 33 40.66		
25	0 33 55.19	26	0 33 42.10	Zenith Distance ..	0 33 49.17
27	0 33 55.24	28	0 33 44.01		
29	0 33 55.28	30	0 33 41.79		
Mean	0 33 54.91	Mean	0 33 42.52		

ε VIRGINIS.

April 26	3 5 18.64	April 25	3 5 4.28	Mean	3 5 11.94
29	3 5 15.82	27	3 5 7.48	Refraction, &c. &c.	+ 2.93
May 3	3 5 16.75	30	3 5 8.67		
				Zenith Distance ..	3 5 14.87
Mean	3 5 17.07	Mean	3 5 6.81		

δ SERPENTIS.

1811.	Left Arc.	1811.	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
May 1	3 53 57.57	May 3	3 53 49.21	Mean	3 53 52.69
4	3 53 56.85	5	3 53 46.99	Refraction, &c. &c.	+ 3.89
7	3 53 58.39	9	3 53 48.29		
15	3 53 56.02			Zenith Distance ..	3 53 56.58
Mean	3 53 57.21	Mean	3 53 48.16		

γ SERPENTIS.

May 3	1 12 25.02	May 1	1 12 18.46	Mean	1 12 22.29
5	1 12 26.94	4	1 12 19.23	Refraction, &c. &c.	+ 1.12
8	1 12 27.70	7	1 12 17.23		
15	1 12 26.61	9	1 12 17.15	Zenith Distance ..	1 12 23.41
Mean	1 12 18.02	Mean	1 12 26.57		

α HERCULIS.

April 26	0 28 37.68	April 27	0 28 27.85	Mean	0 28 33.55
28	0 28 36.47	30	0 28 29.91	Refraction, &c. &c.	+ 0.54
May 1	0 28 36.93	May 2	0 28 28.96		
3	0 28 38.36	4	0 28 31.40	Zenith Distance ..	0 28 34.09
5	0 28 38.69	7	0 28 29.14		
8	0 28 38.68	9	0 28 28.47		
Mean	0 28 37.80	Mean	0 28 29.29		

α OPHIUCHI.

April 26	2 23 12.45	April 25	2 22 59.82	Mean	2 23 85.0
28	2 23 15.73	27	2 23 3.71	Refraction, &c. &c.	+ 2.49
May 1	2 23 14.53	30	2 23 4.88		
3	2 23 13.96	May 2	2 23 3.17	Zenith Distance ..	2 23 10.99
5	2 23 14.10	4	2 23 3.10		
8	2 23 12.74	7	2 23 3.49		
Mean	2 23 13.90	Mean	2 23 3.10		

AQUILÆ.

1811.	Left Arc.	1811.	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
May 14	1 30 56.54	May 10	1 30 46.98	Mean	1 30 52.09
		15	1 30 48.30	Refraction, &c. &c.	+ 1.53
Mean	1 30 56.54	Mean	1 30 47.64	Zenith Distance ..	1 30 53.62

γ AQUILÆ.

May 1	4 57 1.57	May 2	4 56 51.20	Mean	4 56 57.63
4	4 57 1.49	5	4 56 55.63	Refraction, &c. &c.	+ 4.91
7	4 57 2.29	10	4 56 52.88		
11	4 57 2.55	12	4 56 53.70	Zenith Distance ..	4 57 2.54
15	4 57 1.69				
Mean	4 57 1.92	Mean	4 56 53.35		

ATAIR.

May 7	6 44 3.43	May 5	6 43 55.26	Mean	6 44 00.32
9	6 44 4.85	8	6 43 56.20	Refraction, &c. &c.	+ 6.87
10	6 44 5.90	11	6 43 53.63		
12	6 44 4.93	15	6 43 53.33	Zenith Distance ..	6 44 7.19
Mean	6 44 6.03	Mean	6 43 54.60		

β DELPHINI.

May 9	1 10 25.49	May 10	1 10 16.14	Mean	1 10 22.18
12	1 10 28.59	14	1 10 19.53	Refraction, &c. &c.	+ 1.22
15	1 10 25.46				
				Zenith Distance ..	1 10 23.40
Mean	1 10 26.52	Mean	1 10 17.84		

AMPLITUDE

Of the Arc between *Punnae* and *Namthabad.*

STARS.	ZENITH DISTANCES AT		AMPLITUDE.
	PUNNAE.	NAMTHABAD.	
	° ′ ″	° ′ ″	° ′ ″
ο Leonis....	2 36 52.07 N.	4 19 29.91 S.	6 56·21.98
Regulus ..	4 45 24.06 N.	2 10 59.16 S.	6 56 23.22
ϑ Leonis....	8 20 3.44 N.	1 23 42.08 N.	6 56 21.36
β Leonis....	7 30 11.59 N.	0 33 49.17 N.	6 56 22.42
ε Virginis ..	3 51 5.95 N.	3 5 14.87 S.	6 56 20.82
δ Serpentis..	3 2 25.36 N.	3 53 56.58 S.	6 56 21.94
ν Serpentis ..	8 8 46.97 N.	1 12 23.41 N.	6 56 23.56
α Herculis ..	6 27 48.35 N.	0 28 34.09 S.	6 56 22.44
α Ophiuchi	4 33 11.86 N.	2 23 10.99 S.	6 56 22.85
ζ Aquilæ ..	5 25 29.25 N.	1 30 53.62 S.	6 56 22.87
ν Aquilæ ..	1 55 19.77 N.	4 57 2.54 S.	6 56 22.31
Atair	0 12 14.69 N.	6 44 7.19 S.	6 56 21.88
β Delphini	5 45 58.29 N.	1 10 23.40 S.	6 55 21.69
		Mean	6 56 22.25

Celestial Arc between the Parallels of

Punnae and *Namthabad* Station........6° 56′ 22″.25

Terrestrial Arc............2518223.4 Feet.

Mean length of one degree .. 60480.42 Fath.

Latitude of the middle point, 11° 37′ 49″

AMPLITUDE

Of the Arc between *Putchapolliam* and *Namthabad.*

STARS.	ZENITH DISTANCES AT		AMPLITUDE.
	PUTCHAPOLLIAM.	NAMTHABAD.	
	° ′ ″	° ′ ″	° ′ ″
ο Leonis....	0 13 18.16 S.	4 19 29.91 S.	4 6 11.75
Regulus ..	1 55 12.99 N.	2 10 59.16 S.	4 6 12.15
ϑ Leonis....	5 29 54.26 N.	1 23 42.08 N.	4 6 12.18
β Leonis....	4 39 59.4 N.	0 33 49.17 N.	4 6 10.23
ε Virginis ..	1 00 55.20 N.	3 5 14.87 S.	4 6 10.07
δ Serpentis..	0 12 14.15 N.	3 53 56.58 S.	4 6 10.73
α Herculis ..	3 37 38.58 N.	0 28 34.09 S.	4 6 12.67
α Ophiuchi	1 43 00.69 N.	2 23 10.99 S.	4 6 11.68
ζ Aquilæ ..	2 35 16.44 N.	1 30 53.62 S.	4 6 10.06
ν Aquilæ ..	0 50 50.74 S.	4 57 2.54 S.	4 6 11.80
Atair	2 37 54.13 S.	6 44 7.19 S.	4 6 13.06
β Delphini..	2 55 45.68 N.	1 10 23.40 S.	4 6 9.08
		Mean	4 6 11.28

Celestial Arc between the Parallels of

Putchapolliam and *Namthabad*.........4° 6′ 11″.28

Terrestrial Arc ....1489122.9 Feet.

Mean length of one degree .. 60487.27 Fath.

Latitude of the middle point..13° 2′ 55″

It will scarcely be worth while to make any deductions until my meridional operations be finished, and those in England extended further. I shall only observe that if the degree in latitude 11° 37′ 49″ as I have brought it out, be taken with the *English*, *French*, and *Swedish* measures respectively, and applied to the formulæ in Art. 2. in the Appendix to my last paper, the ratio of the polar to the equatorial diameter of the earth will be as 1 : 1.0032183, 1 : 1.0034688, and 1 : 1.0032811, respectively, whose mean is 1 :1.0033227 or an ellipticity of $\frac{1}{300\cdot96}$ nearly.

And if this mean ratio, of 1 to 0033227 be used with the degree in 11° 37′ 49″, and the other degrees in latitudes 9° 34′ 44″; 13° 2′ 55″ computed according to the formulæ in Art. 3 in the same Appendix, they will come out 60472.6 and 60486.47 respectively, differing only 0.21 and 0.63 fathoms from the observations, and these differences would hold good, where the three latitudes are so near each other, in any hypothesis of the Earth's figure that has resulted from the recent measurements. So near a coincidence of the observations with the elliptic theory, I must own has the appearance of chance. However if a series of observations two degrees further to the northward, should prove equally regular, the accuracy of the whole may be in a great measure relied on, and I shall then feel desirous of repeating the observations made at *Dodagoontah* in 1805; for to all appearance no part of the country could be more favourable, and it is possible, that at the commencement of my observing with the zenith sector, there might have been some oversight in using so delicate an instrument. I am not however aware that there was; but if the irregularity was occasioned by the attraction of dense matter to the northward, the matter must have been nearer to the place of observation, than I have hitherto supposed it to be.

It may be necessary to notice here, that in Art. 2. of the Appendix to my last paper, there has been an

oversight in taking the mean of two computed degrees, 60465.5 and 60498, which mean is $60481\frac{3}{4}$ in place of $60485\frac{3}{4}$; or 60482 to latitude 11° 6′ 24″, which must therefore affect all the results given in that paper. But as the principal ones are computed according to the present measurement, it is unnecessary to recompute those formerly given. By using the mean ratio of 1 : 1.0033227, with the degree 11° 37′ 49″, equal to 60480.42 fathoms, the degree of longitude at the equator will come out 60858.47 fathoms, and the length of the equatorial diameter of the earth will be 6973866 fathoms, from whence, by proceeding as in Page 97, of this volume, the quadrantal Arc of the elliptic Meridian will be had, equal to 5468170.8 fathoms, or 3937082976 inches, which divided by 10.000000, will give 39.37083 *English* inches for the measure of the *French* metre measured at the temperature of 62° which differs only $\frac{1}{5882}$th part of an inch from that measured by the *French* mathematicians at 32° and reduced to the same temperature.

Latitudes and Longitudes

Of the great Stations, and some principal Places, as deduced from the Meridional Arc.

NAMES OF PLACES.	Latitudes.	Longitudes from	
		Madras Observatory, W.	Greenwich, E.
	° ′ ″	° ′ ″	° ′ ″
* Hallagamalli	11 0 52	2 48 54	77 29 36
* Yaëlmatoor hill	11 12 16	2 30 12	77 48 18
* Eerode, *(S. W. angle of the Fort)*	11 20 27	2 31 36	77 46 54
* Thittamalli	11 20 49	2 53 49	77 24 41
Bhavany Pagoda	11 25 45	2 34 19	77 44 11
* Woorachmalli	11 28 37	2 33 43	77 44 47
Sankerrydroog	11 28 51	2 23 41	77 54 49
Sattimungalum Pagoda	11 30 17	3 00 38	77 17 52
* Kumbetarine hill	11 35 31	2 58 57	77 19 33
Salem, *(S. W. angle of the Fort)*	11 39 9	2 5 49	78 12 41
* Paulamalli	11 41 39	2 31	77 47 30
Womooloor, highest cavalier	11 44 8	2 12 48	78 5 42
Cauverypoorum	11 54 43	2 29 36	77 48 54
Darampoory	12 3 48	2 5 5	77 13 25
Pennagra	12 7 45	2 20 58	77 57 32
Allambaddy	12 8 35	2 30 25	77 18 5
* Ponnassmalli	12 8 47	2 36 27	77 42 3
* Bundhully hill	12 12 16	2 55 2	77 23 28
Sattiagul	12 14 38	3 6 32	77 11 58
Mallavilly	12 23	3 11 54	77 6 36
Gopauldroog	12 29 52	2 57 31	77 20 59
Ryacottah, *(Flag Staff)*	12 31 16	2 12 54	78 5 36
Denkanicottah	12 31 53	2 27 53	77 50 37
Kistnagherry	12 32 15	2 2 9	78 16 21
Anchittydroog *(Muntapum)*	12 35 23	2 21 45	77 56 45
* Deorabetta	12 37 32	2 37 35	77 40 55
Annicul Fort	12 42 33	2 33 31	77 44 59
Oossoor hill and Pagodah	12 43 34	2 24 52	77 53 38
* Bonnairgottah	12 48 43	2 40 41	77 37 49
Anniculdroog	12 49 36	3 2 51	77 15 39
* Savendroog	12 55 10	2 57 40	77 20 50
Bangalore Palace	12 57 34	2 40 45	77 37 45
* Dodagoontah	13 0 4	2 37 40	77 40 50
* Muntapum centre	13 0 45	2 40 13	77 38 17
Goonicul	13 1 33	3 13 34	77 4 56
* Tirtapully hill	13 2 25	2 21 56	77 56 34
Oosscottah Mosque	13 4 21	2 28 13	77 50 17
Byrandroog	13 5 41	3 4 47	77 13 43
Colar Fort, *(Pagoda)*	13 8 20	2 6 49	78 11 41
* Allasoor hill	13 9 42	2 38	77 40 30
Shevagunga Pagoda	13 10 9	3 1 51	77 16 39
Deonelly	13 4 59	2 32 38	77 45 52
B. Ballapoor Eedgah	13 18 24	2 43 13	77 35 17
* Cheetkul hill	13 19 16	2 58 52	77 19 38

NAMES OF PLACES.	Latitudes.	Longitudes from	
		Madras Observatory, W.	Greenwich, E.
	° ′ ″	° ′ ″	° ′ ″
* Rymandroog	13 21 17	2 14 37	78 3 53
* Nundydroog	13 22 12·5	2 34 1	77 44 29
* Devaroydroog	13 22 25	3 2 28	77 16 2
* Kulkotah hill	13 25 14	2 39 9	77 39 21
Macklydroog	13 25 58	2 45 4	77 33 26
Minchiculdroog	13 27 27	3 3 16	77 15 14
* Baelippee hill	13 39 7	2 58 28	77 20 2
Mudgherrydroog	13 39 7	3 3 11	77 15 19
Goodeebundah	13 40 34	2 33 3	77 45 27
Busmungydroog	13 44 24	3 12 57	77 5 33
Serah, *(Flag Staff)*	13 44 39	3 20 29	76 58 1
Meddagashiedroog	13 49 54	3 3 34	77 14 56
Kodicondah	13 49 49	2 28 24	77 50 6
* Yerracondah	13 54 59	2 36 5	77 42 25
Mudduksera h	13 56 41	2 59	77 19 30
Pencondah, *remarkable tree*	14 4 13	2 40 2	77 38 28
* Paughurdroog	14 6 19	2 58 34	77 19 56
Kaummundroog	14 14 59	2 58 44	77 19 46
* Ooracondah	14 15 51	2 38 44	77 39 46
Durmahveram Palace	14 17 49	2 27 34	77 50 56
Kunnaganpully Pagoda	14 26 52	2 44 8	77 34 22
* Condapilly hill	14 31 57	2 50 59	77 27 31
Hundee Anantapoor	14 40 59	2 38 39	77 39 51
* Ooderpeedroog	14 49 59	2 54 31	77 23 59
* S. end of the base, *(Eeranapilly)*	15 0 59	2 36 24	77 42 6
* N. end of the base, *(Namthabad)*	15 5 53	2 38 43	77 39 47
* Namthabad Station	15 6 00·6	2 38 46	77 39 44
* Konakoondloo hill	15 6 39	2 53 3	77 25 27
* Gootydroog	15 6 54	2 36 7	77 42 23
* Guddaculgooda	15 7 19	3 00 51	77 17 39
* Paumdy hill	14 57 54	2 40 15	77 38 15
* Koelacondah	15 19 21	2 38 39	77 39 51

Note. All Places marked with the Asterisk (*) are great Stations.

11. *Elevations and Depressions.*

Contained Arcs, and Terrestrial Refractions, together with the Heights above the Level of the Sea, of the principal Stations.

Stations at	Stations observed.	Apparent Elevations and Depressions	Contained Arcs.	Refraction.	Elevations above the Sea.	
					Stations.	Heights.
		° ′ ″	′ ″			Feet.
Yerracondah........	Tirtapully.........	0 16 19 D.	25 4	$\frac{1}{24}$	Tirtapully..........	3182.9
Tirtapully.........	Yerracondah........	0 6 39 D.				
Tirtapully.........	Bonnairgottah......	0 7 16 D.	22 49	$\frac{1}{21}$	Bonnairgottah......	3305.1
Bonnairgottah......	Tirtapully.........	0 13 20 D.				
Bonnairgottah......	S. end of the base...	0 25 38 D.	7 11	$\frac{1}{40}$	S. end of the base ..	3023.6
S. end of the Base ..	Bonnairgottah......	0 18 49 E.				
Bonnairgottah......	Dodagoontah........	0 18 10 D.	11 40	$\frac{1}{17}$	Dodagoontah	3037.9
Bonnairgottah......	Deorabetta	0 0 0	11 35	$\frac{1}{16}$	Deorabetta..........	3408
Deorabetta.........	Bonnairgottah......	0 10 6 D.				
Savendroog	Bundhully..........	0 15 41 D.	42 59	$\frac{1}{17}$	Bundhully..........	4254.5
Bundhully..........	Savendroog	0 22 17 D.				
Bundhully..........	Kumbetarine	0 3 26 E.	36 56	$\frac{1}{18}$	Kumbetarine	5548.6
Kumbetarine........	Bundhully..........	0 36 23 D.				
Deorabettah........	Ponnassmalli	0 17 18 E.	28 47	$\frac{1}{17}$	Ponnassmalli	4928.8
Ponnassmalli	Deorabettah........	0 42 45 D.				
Ponnassmalli	Paulamalli	0 16 46 D.	27 40	$\frac{1}{9}$	Paulamalli	4958.8
Paulamalli.........	Ponnassmalli	0 13 1 D.				
Paulamalli.........	Woorachmalli	2 34 47 D.	13 18	$\frac{1}{22}$	Woorachmalli	1472
Woorachmalli	Paulamalli	2 22 42 E.				
Woorachmalli	Shennimalli	0 0 6 D.	20 7	$\frac{1}{20}$	Shennimalli	1788.6
Shennimalli	Woorachmalli.......	0 17 58 D.				
Tirtapully hill......	Allasoor hill	0 1 40 D.	17 16	$\frac{1}{35}$	Allasoor hill.......	3380.6
Allasoor hill.......	Tirtapully hill......	0 14 38 D.				
Allasoor hill.......	Kulkotah hill	0 6 17 D.	15 34	$\frac{1}{28}$	Kulkotah hill	3406.6
Kulkotah hill	Allasoor hill.......	0 8 11 D.				
Kulkotah hill	Yerracondah........	0 23 45 D.	29 54	$\frac{1}{16}$	Yerracondah	2848
Yerracondah........	Kulkotah hill	0 2 30 D.				
Yerracondah........	Paughurdroog	0 6 9 D.	24 34	$\frac{1}{17}$	Paughurdroog	3052.
Paughurdroog	Yerracondah........	0 15 35 D.				
Savendroog	Cheetkul hill	0 26 33 D.	24 7	$\frac{1}{17}$	Cheetkull hill	3329.3
Cheetkul hill........	Bailippee hill	0 25 34 D.	19 52	$\frac{1}{31}$	Bailippee hill	2760.6
Bailippee hill	Cheetkul hill	0 6 59 E.				
Yerracondah........	Ooracondah	0 24 35 D.	20 57	$\frac{1}{8}$	Ooracondah	2223
Ooracondah	Yerracondah	0 9 19 D.				
Ooracondah	Davurcondah	0 17 4 D.	24 53		Davurcondah	1876
Davurcondah	Ooracondah	0 1 23 D.				
Davurcondah	Gootydroog	0 4 27 D.	26 17	$\frac{1}{9}$	Gootydroog	2171
Gootydroog	Davurcondah	0 17 16 D.				

Stations at	Stations observed.	Apparent Elevations and Depressions	Contained Arcs.	Refraction.	Elevations above the Sea.	
					Stations.	Heights.
		° ' "	' "			Feet.
Paughurdroog	Condapilly	0 26 19 D.	26 35	1/7	Condapilly	2282
Condapilly	Paughurdroog	0 6 37 E.				
Condapilly	Ooderpeedroog......	0 17 0 D.	18 22	1/4	Ooderpeedroog......	1852
Ooderpeedroog......	Condapilly hill	0 9 39 E.				
Ooderpeedroog......	Guddaculgooda	0 3 44 D.	18 26	1/6	Guddaculgooda	1918
Guddaculgooda	Ooderpeedroog	0 8 25 D.				
Guddacul	Paumdy hill........	0 12 2 D.	22 10	1/7	Paumdy hill........	1762
Paumdy hill........	Guddacul	0 4 1 D.				
Gootydroog	S. end of the base ..	1 42 53 D.	5 56	1/3	S. end of the base ..	1111
S. end of the base ..	Gootydroog	1 41 44 E.				
Paumdy hill	N. end of the base ..	0 37 34 D.	8 7	1/4	N. end of the base ..	1253
N. end of the base ..	Paumdy hill........	0 33 38 E.				
Paumdy hill	Konakoondloo	0 05 11 E.	15 10	1/6	Konakoondloo......	2036
Konakoondloo......	Paumdy hill........	0 15 19 D.				
Guddacul	Koelacondah........	0 6 17 D.	24 33	1/8	Koelacondah	2042
Koelacondah	Guddacul	0 11 59 D.				

IX.

Translation of a Sanscrit Inscription on a Stone found in Bundélc'hand.

By Lieutenant W. PRICE.

To H. T. COLEBROOKE, Esq.

PRESIDENT OF THE ASIATICK SOCIETY.

SIR,

A few months since, while on duty with my corps in *Bundélc'hand*, I observed a stone, containing a Sanscrit inscription, lying at the foot of a rocky hill in the vicinity of the town of *Mow*, about ten miles distant from *Chatterpur*. As it appeared to me, on a cursory inspection, to comprise a genealogy of princes that might tend to illlustrate some doubtful points in *Indian* history, and, on this account, to merit preservation, I caused it to be removed with the intention of examining it at a future period. I have lately succeeded in decyphering the greatest part of the inscription, and now beg leave to present the monument to the *Asiatick* Society, and to

lay before them a correct transcript of the original, in the modern *Dévanâgari* character, with a literal translation.

The stone measure 3 feet 6 inches in height, 4 feet 7 inches in width, and about 6½ inches in thickness. The natives were accustomed to sharpen their knives and *talwars* upon it: from this and other causes, it is much mutilated; considerable portions of the inscription are illegible: and of the last line, in particular, which probably contained the date, not a letter can be traced. The character does not materially vary from the current *Dévanâgari*, excepting some few letters, which are formed in a very unusual manner, and approach nearer to those used in the *Dek'hin*, than to any others with which I am acquainted.

I regret my inability to offer any opinion regarding the antiquity of this memorial; and the oldest residents of *Mow* could afford me no information, farther than, it had lain where I discovered it, during their recollection, and that of their parents. In a metaphysical and theological drama, entitled *Prabód'ha Chandródaya*, or the rise of the moon of intellect, CÍRTTIVARMA is introduced by the author as the king before whom it was first represented; but I will not pretend to determine whether he is the same with the prince of that name mentioned in the inscription: and indeed if they could be identified, the circumstance would lead to no satisfactory conclusion, the age of the play being equally involved in doubt.

I have only further to observe, that some passages of the original are very obscure; from the context being effaced, and admit of various interpretations. In these instances, I noted down the different senses in which they might be rendered, and selected that reading which appeared to be the most eligible and consistent: and

where any doubt attaches to a particular term, I have usually specified it in the notes which accompany the translation.

I remain,
SIR,
Your obedient Servant,
WILLIAM PRICE,
Lieut. 5th Regt.
Bengal Nat. Inf.

CALCUTTA,
1st *September* 1813.

———————— : श्रीक — ङ्क्द्वदपि
वपुर्द्दिव्यमव्यक्तपद्ममायाजालैर्यमितभुवनोप्येकहेतु
र्विमुक्तै————————————
————————————.
— — पत्रावलीभासंश्रिःप्रौद्य — — ोकुचकलशत
टाङ्कक्षसिश्रीधस्य ॥सत्रांतापातुयुष्मानत्तिविशदलि
—ीयाशिलामेविन्यस्तामन्मथेनान्मदसुरतवि
धि— — हेवप्रभासि: ॥२॥ ————
———— नामनरेन्द्र: ॥— — मखिलवृ
षंय:कान्यकुब्जंनरेन्द्रंसमरभुविविजित्यप्रापसाम्रा
ज्यमुच्चैः ॥ ३ ॥ दर्पकण्डनदोर्द्दण्डद्विषद्दण्डनप
ण्डित: ॥ गण्डदेवो ऽभवत्स्साच्चतुरन्तावनीश्वर:

॥४॥ तस्मादशेषनरपतिमौलिषुविश्रान्तकान्तप
दकमलः ॥ श्रीविद्याधरदेवः——————
वासवोजज्ञे ॥५॥ अजनिविजयपालःस्फारकी
र्त्याविशालःशुभचरितपवित्रस्तस्यराज्ञःसुपत्रः ॥
क्षपितनिखिलदुष्टःप्रीणिताशेषशिष्टःकृतकलि
——ि—ः क्षोणि——————ः ॥६॥
——त्रयमतिपुण्यकीर्त्तिस्तनयेास्याजनिकीर्त्तिव
र्म्मदेवः ॥ ——ा तःकलि———ों—दंडं—
प—ाधर्म्मद्द——होवतीर ाः ॥७॥ जिग्येयेना
रि————लसममरिभिःषड्भिरेवान्तरङ्गैःसा
र्द्धंधर्म्मेणनीतान्यनुदिनमधिकंवृद्धिमङ्गानिसप्त ॥
उच्छिन्नःकण्टको गो जगतिकलिमलंन——ा
रेणसाकं —ा संचारिताबाजलधिपरिसरंस्फार
कीर्त्तर्यासदेवः ॥८॥———————विक्रमदर
प्रोन्निद्रितारिःसदाश्री———— वर्म्मदेवनृप
तिस्तस्यात्मजोभूत्प्रभुः ॥ धौरेयःश्रुतशालिनांगुण
वतांबन्धुःकलानांनिधि : सद्वृत्तस्यचसद्मकल्पविट
पीनिः —े—— त्यार्थिनाम् ॥९॥ येनाच्छिद्या
रिलक्ष्मीमखिलकुलजनेयच्छनोच्चैर्निरस्तासानष्टा
दुःख————————श्रियेकिंचयस्य ॥
राज्ञांसेवागतानांकनकमणिमयेाद्भासिनेपथ्यसाम्या
दन्येषांचाश्रितानांसदसिकिमपिनाभूद्विशेषोपल

म्भः ॥१०॥ अ — — तद्यनयशौर्य्यनिवासभूमि
स्तस्याजनिष्ठतनयोजयवर्मदेवः ॥ यस्यप्रतापतप
नाभ्युदयेनभूपादीपाइव — — — — : — — रान
रेजुः ॥११॥ श्रीसल्लक्षणवर्म्मक्षोणीनाथस्यसोदरो
ऽवरजः ॥ अथपृथ्वीवर्म्मनृपकुलराज्यधुरांदधौ
धुर्य्यः ॥१२॥ अशिष्टेप्रद्वेषोभृशमविरतिः पात्रनि
वहेजिघृक्षान्यार्थ्येर्थेविधिवदथतीर्थेवितरणम् ॥
परारक्षाभूतेष्वपिचविनयादानपरतावितेनेयेने
थंकृतचरितमुच्चैरिहकला ॥१३॥ अजनिमदनव
र्म्मभूमिपालस्त्रिभुवनविश्रुतविक्रमोऽथतस्मात् ॥
भुजवलमवलोक्ययस्यमेनेऽद्भुतवलसीमकथाजनैर
मिथ्या ॥१४॥ द्रागिवद्रात्पेवचैद्यःसमरभरजितो
यस्यनाम्नापितित्यंकामंसौहार्दवृत्यागमयतिसततं
त्रासतःकाशिराजः ॥ येनौद्धत्यंदधानःसवतघटि
समुन्मूलितोमालवेशस्तन्वम्तोयत्रभक्तिंपरमवनिभु
जःस्वास्थ्यमन्येचभेजुः ॥१५॥ कृष्टायांवेगवल्गत्तु
रगखुरपुटैर्वैरिकण्ठावमुक्तैः सिक्तायांरक्ततोयैः
समरभुविभृशंतेनशुभ्रांशुगौरम् ॥मुक्तावीजंयदुप्तंरि
पुकरिशिरसांकीर्त्तिवल्लीततनोऽभुत्तत्यागांभःप्रसेका
त्कमलभवसभामण्डपंयानशेसा ॥१६॥ अथनृप
तीनामेषांयेराज्यधुरंधरामहामात्याः ॥ अभवन्
विशुद्धचरितास्तद्वंशःकीर्त्यतेऽधुनावन्ध्यः ॥१७॥

मूनुर्व्विश्वसृज समस्तभुवनैर्य्यैमाननीयोङ्गिरास्तद्वंशे भगवानजायतमुनिर्व्विद्यानिधिर्गौतमः ॥ द्राग्मीमांसकदूषिणाप्रकटितेभालेक्षणेशम्भुनारोवाद्वादविधौनिजेपदतलेयेनाक्षिसन्दर्शितम् ॥ १८ ॥ न्यायदर्शतविकासनदक्षः सो ऽ क्षपादइहकस्यनवंद्यः ॥ प्रत्यतिष्टिपदपास्यकुतर्कानीश्वरस्यमहिमातिशयंयः ॥ १९ ॥ तस्योदग्रतपःप्रसादवसतेर्गोत्रेविवृद्धेक्रमात्पुण्यैकायतनंगुणौघसदनंजज्ञेप्रभासःसुधीः ॥ अत्युद्दामसरस्वतीविलसतेनोद्भासितंसादराःप्राभासंकृतिनःसुतीर्थमिवयंद्रष्टुंययुःश्रेयसे ॥ २० ॥ सर्व्वोपधाशुद्धिमतान्धुरीणोधंगेनगंडेनचभूभृतायः ॥ नयप्रयोगेगहनेसदक्षःपरीक्ष्यचक्रे ऽ चिलमंत्रिमुख्य ॥२१॥ सुदृढतरबद्धमूलःसमेधितस्त — — — सेक्तेन ॥ राज्यतरुरभवदनयोस्त्रिवर्गफलदःसदानृपयोः ॥२२॥ बुद्ध्याश्रुतेनवद्धनाधिषणायनेन —— —— तपोज्वलयशाभृतदिग्वितानः ॥ आजौविपक्षनिवहैरवि — — — — तस्मादजायतकृतीशिवनामनामा ॥२३॥ अभिष्टोतुंशक्यंकथमिवगुणास्तस्यसुमतेर्यपकः सद्वृत्त : सचिवप — — — — महितं ॥ क्रमाद्राज्यंविद्याधरनरपतेर्नित्यकरदीकृताशेषोर्वीशंयधितभुविसर्व्वातिशयितम् ॥२४॥ विशुद्धाद्दुग्धानेर्व्विधुरिव

जन्नेत्रसुभगौमहीपालस्तस्मादभवदभिरामोऽज्ज्वलगृ
णः ॥ गिरंसत्येनखांमतिमखिलकार्य्यैःसफलितैर्य
इष्टापूर्त्ताभ्यांश्रियमपिकृतार्थत्वमनयत् ॥२५॥
अविकलगुरुकार्य्यधुरंभरविजयपालनराधिपतेर्द्द
धत् ॥ सनिरवद्यनयान्वितविक्रमःसुसचिवेषुबभू
वनिदर्शनम् ॥२६॥ — — — — — सद्गोगनि
त्योद्गासिवषःकृती ॥ जगद्धरक्षमोजज्ञेऽनन्तो
नन्तगुणस्ततः ॥२७॥ अभूद्भूरिगुणाधारोयस्ययो
गेश्वरोऽनुजः ॥ सरामस्येवसौमित्रिः — — — —
धनव्रतः ॥२८॥ अत्युच्चैरुदितोदितंकुलमिदंब्रा
ह्मण्यमत्युज्ज्वलंवेदस्याध्ययनंश्रुतंचविमलंश्रीः शि
ष्टताकारिणो ॥ शौर्य्यंदुर्व्विषहंरणेषुसततंसर्वत्रवा
क्सूनृताऽनन्तस्यास्यमहात्मनःशुभमतेःकिंकिन्नलो
कोत्तमम् ॥२९॥ मंत्रीमंत्राधिकारेसुमहतिहृदयंगू
ढविश्रम्भकृत्पोनत्थंहस्त्य — — णारिपुषु उ —
वलायत्तप — — गोप्ता ॥ निर्ज्जैताशात्रवाणां —
ि — — ि — — — — सर्ववीरैकधुर्यःकार्य्येकस्मिन्न
सोऽभूदभिमतसचिवःकीर्त्तिवर्म्मेश्वरस्य ॥३०॥
युक्तश्चेत्सुदिवोगुणैरभिजनप्रज्ञाप्युचित्यादिभिर्न्नै
तास्यान्ततदास्फुटनृपतिनाकाचिद्धरावोन्नतिः ॥
तस्मिन्नेतृवरेऽनुशासति — यं — त्कीर्त्तिवर्म्मप्रभुः
कीर्त्यासच्चरितैःश्रियाचजि — — धर्मात्मजा —

— — ॥३१॥ — — — — — — वन्हिधूमनिवहैर
त्यर्थमभ्रंलिहैरभ्रभ्रांतिभृतामशेषशिखिनांनृत्तक्रिया
हेतुभिः ॥ — — — श्रितलो — — पिमघवायज्ञां
शभ — — धर्म्मस्तस्यगुणोत्तरेहिगणयत्यत्प — —
महान् ॥३२॥ त्र्प्रासर्व्वानाममहार्हवंशजापुण्यच
रितमहनीया ॥ अनसूया ऽत्रिमुनेरिव — — — —
— — — — — — — ॥३३॥ द्वितीयापिचतस्या
भूद्भार्य्यासत्कुलसंभवा ॥ क्षमाशीलार्ज — — — —
— — — — — — — — — ॥३४॥ — — — —
— — — मनघं ॥ वत्संनामसुर्मीधिष्ठितमभ्युन्नतंसु
नेत्रमिव ॥३५॥ — — स्वच्छमतिर्विशुद्धचरितः
सौजन्यरत्नाकरोवि — — — हरश्चशौर्यगरिमव्रा
ह्मण्य — — — — — — — — — ताधरोगुणनि
धिःसाधुप्रियोवामनःप्रद्युम्नश्च — — — — — —
— — — — — — — — — — ॥३६॥ — — — —
विमुनातिगुणा नु — रायात्सल्लक्षणक्षितिभुजाच
परीक्ष्यभावान् ॥ सर्वे ऽमुनान्य — — — — —
रंनियुक्ताःकार्येषुसद्भशुचिशूरजनोचितेषु ॥३७॥
अथसल्लक्षणवर्म्मा — — — — — — — पुनः ॥
अन्तर्व्वेदीविषये — — — — — ॥३८॥ —
— — — — — — — शौर्ये ऽद्रेकविनिर्ज्जिता
निजविभोःपादावनम्रीकृताः ॥ कृत्वाकंटकशोध

नंजनपदे ऽपास्यप्रजानांभयंताभ्यःसंविदधेचवृ
द्धिरसमाकोशस्यदंडस्यच ॥३९॥ हित्वादेहंत्रि
------ भानुकन्याजलान्तःश्लाघ्येऽननो
------- रिमब्रह्मसायुज्यमाप्ते ॥ शास्ता
रीणामितिसजयवर्म्मावनीन्द्रेणयत्नादात्माभक्तयैप्र
थितमतिनाप्रातिहार्ये नियुक्तः ॥४०॥ मौलःसद्वं
शजन्माशुचिरमलमतिःशास्त्रविद्दृष्टकर्म्मावाग्मीद
क्षःप्रगल्भःकरितुरगरथारोहविज्ञःकृतास्त्रः ॥
----- ऽनुरागप्रभृतिगुणयुतश्चे ---
नुभावश्रीपृथ्वीवर्म्मनाम्नातदनुनृपतिनामंत्रिमुख्य
श्चचक्रे ॥४१॥ सर्व्वैरंगैःसमृद्धंव्यधितनिपुणधीस्तस्य
राज्ञोथराज्यंसाचिव्येपि --- ---मदन
क्षोणिपालस्यसोयम् ॥ षाड्गुण्यादिप्रयोगैःसमयस
मुचितैःप्रत्यभावंमरीद्रान्नीत्वासर्व्वान्क्रमेणव्यतनुत
वसुधैश्वर्य्यमेकात -- ॥४२॥ ------
क्षमोपिविविधैयुक्तोगुणैर्धैरपिश्रीमान्नोद्धतिमान्ग
दाधरइतिब्रूतेजनोयंसदा ॥ गाम्भीर्येणपयोनि
धिंह --------- प्यसौवुद्ध्याधःकृत
वानगुरुश्चतदियंकिन्ताद्दतिभूयसी ॥४३॥ कलत्रं
सन्तत्यैश्रुतमपिसदाचारशिधयेम --॥ -- त्यैवेदा
वसुसकललोको -----॥------

प्रवणमनस स्तस्यचरितैःकलिस्तंप्रत्यस्तंगतइवसमे
नेखलुजनैः ॥४४॥ पुत्राःश्रीधरविद्याधरादयो
यद्गुणैर्जगज्जयिनः ॥ तस्याभूवन्सततनेाधुरिस्थितः
सर्वपुत्रवताम् ॥४५॥ इष्टापूर्तप्रचुरसुकृतारम्भ
मित्याद्दतेनप्रासादोऽयं — — — गु युतस्तेननिर्मा
प्यतेस्म ॥ प्रत्य — — — — — — — — — —
यणोऽस्मि — — :सोयंवसुहिमहतांपुण्यकर्म्मो
पयोगि ॥४६॥ किञ्चात्यर्थविशुद्धैर्वसुभिरतिम
हान्कारितस्तेनयत्नाद्द्वग्रामस्यसीम्निप्रचुरपृथुशि
लाबन्धर — — — —ः ॥ कूलेऽभेद्य ततस्योपल
मयरचनाऽप — — — — — — — — —
— — ॥४७॥ — — — — णप्र
देशे ॥ घटिताश्मयकदम्बकेनव — — रणःकारितइ
ुगौरनीरः ॥४८॥ केडीनामद्विज — — शास
नया — — — — ॥ धनेशकृतिनाजनोप — —
————————————————————
————————————————————
————————————————————

TRANSLATION.

1. * ————————————————————

2. ————————————————————

3. ————————————————————the lord of men † so named; who, having overcome the king of *Cányacubja* ‡, chief amongst all, in battle, obtained exalted sovereignty.

4. From him sprang GAN'D'A DE'VA, skilful in punishing his enemies, whose arms were two staffs to crush their pride, and who was monarch of the four quarters of the earth.

5. From him was produced the fortunate VIDYA'D'HARA DE'VA, whose beautiful lotus-foot rested on the heads of all kings . . . .

6. Of that prince was born the warlike VIJAYA PA'LA, a duteous son, eminent from wide-spread fame, and purified by virtuous deeds; by whom all the wicked were exterminated; by whom all the good were rendered happy . . . .

* This, and the following stanza comprise an invocation to VISHN'U: they have not been completely decyphered, and it is therefore unnecessary to insert a translation of those portions, which, being legible, appear in the copy of the original.

† The name of this prince is not legible in the inscription: but from the 21st verse, I judge D'HANGA must be here mentioned.

‡ Vulgarly called *Cannouge*: JAYACHANDRA, the celebrated *Hindu* sovereign of *India*, held his seat of empire there at the time of the *Musselman* invasion, when his government was subverted.

7. His son was CÍRTTI VARMA DE'VA, of good renown, ... as if virtue had descended in a human form; who vanquished . . . . through the aid of his six allies*; and, by justice, daily promoted the seven requisites of regal administration †. This prince, extracting the thorns of the world, and removing the impurities of the *Cali* age, was famed unto the sea-shore.

9. His son was the fortunate . . . .‡ VARMA-
DE'VA, a king and ruler. . . . . whose
foes from a dread of his prowess never slumbered; who
was at the head of those versed in the sacred sciences, a
friend of the good, a treasure of the mechanic arts, an
10 abode of moral conduct, and the all-productive tree of
the poor: who, having taken vast riches from his enemies,
distributed them amongst his subjects . . . . .
. . . . moreover, in
whose assembly there was no difference whatever to be
perceived between the tributary princes and his other
dependents, from the similarity of their glittering ornaments of gold and jewels.

11. JAYA VARMA DE'VA was born his son, the residence of virtue and power, from the rising of whose sun of majesty, other kings, like lamps, shone not . . . .

12. The fortunate SALLACSHANA VARMA was the uterine and younger brother of this lord of the earth:

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* The original word is '*antarangaih*,' which I have translated in it's most probable sense. The term will, however, admit of other interpretations.

† They are thus enumerated in the *Amera ćósha*: 1st. the king or lord; 2d. his counsellor; 3d. a friend or ally; 4th. treasure; 5th. territory; 6th. a strong hold; 7th. an army.

‡ Four letters which compose his name are here effaced.

afterwards, the prince PRĬT'HVÍVARMA, equal to the task, sustained the burden of the hereditary government.

13. Averse from the vicious, having a great esteem for the society of fit persons, desirous of taking lawful wealth, and then bestowing it according to form at a sacred spot, carefully protecting all sentient beings, and receiving wholly with humility, he thus greatly benefited his interest in this life, by practising virtuous deeds.

14. From him was born MADANA VARMA*, the
protector of the earth, whose vast power is celebrated
throughout the three worlds†: the story of the extent of
15 his extraordinary might is credited by those who have
witnessed the strength of his arms‡. From whose name
even, the king of *Chédi*§, vanquished in the fierce fight,
ever quickly flees; and the prince of *Cás'i*||, through
dread, by his conciliatory conduct always passes his time
in undisturbed tranquillity: by whom the misbehaving
lord of *Málava*¶ was in the space of an hour exterminated;
and at whose court, other monarchs, by an
increase of confidence, obtain peace.

16. The field of battle being ploughed by the trampling of the hoofs of his horses impetuously charging, irrigated with the blood gushing from the throats of his enemies, sown with pearls, bright as the pale-beamed

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* In whose reign it would appear this memorial was composed.

† Heaven, earth, and hell.

‡ It is here to be understood that he was a prince of great athletic accomplishments.

§ The same, I believe, with CHANDAIL (as the name is written in Major RENNELL's Atlas), S.E. of the province of *Bundélc'hand.*

|| *Benares.* The original term '*Cási rája,*' may however be assumed as the proper name of some other chief; for it is not an unusual one.

¶ S.W. of *Bundélc'hand.*

luminary, from the heads of the elephants* of his foes, yielded glory, the creeping plant, which, being sprinkled with the water of libation †, overspread the assembly-house of Him ‡ sprung from the lotus.

17. The venerable lineage of the ministers of these princes, the supporters of the weight of government, and of upright conduct, is now to be detailed.

18. The descendant of the Creator of the universe § was ANGIRAS, worthy the esteem of the whole world: in his line was born the divine sage GAUTAMA ‖ a treasure of science, an opponent of the followers of the *Mimánsa* system ¶, who from anger in disputation shewed an eye in the sole of his foot**, as S'AMB'HU †† displays
19 it on his forehead. Whose praise does not ACSHAPA'DA merit in this world, who, quick in expounding the *Nyáya Sástra*, having confuted wicked doctrine, proved the omnipotence of IS'WARA?

20. In the increase of the race of him resting in the tranquillity of devout austerity was born the wise PRAB'-H'ASA, the sole abode of virtue, and the residence of a multitude of excellent qualities; who was enlightened by

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* The *Hindus* imagine that the finest pearls are to be found in the heads of elephants.

† Solemn gifts are ratified by pouring water into the hands of the person receiving them.

‡ BRAHMA, who sprang from the lotus which arose from the navel of VISHNU.

§ BRAHMA. According to the *Hindu* mythology, ANGIRAS was his great-grandson.

‖ Author of the *Nyáya* or system of logic, the doctrines of which are said to correspond with those of ARISTOTLE.

¶ Founded by VYA'SA, and generally supported by his pupil JAIMINI. Their several systems are distinguished by the titles of *Púrva* and *Uttara*, or first and second *Mimánsá*.

** He is hence named ACSHAPA'DA. The legend is, however, differently related by other writers.

†† 'SIVA.

the embraces of exalted SARASVATÍ*, and whom pious
21 men visited as a holy place for their moral good. That
skilful one, at the head of those who are pure from tried
fealty, having been examined, was appointed chief of all
the ministers for conducting abstruse politics by the monarchs D'HANGA, and GAN'D'A DEVA.

22. The tree of loyalty, whose roots were firmly fixt, being watered with . . . . grew up, and ever produced to these two princes the fruit of the three human pursuits†.

23. From him was born the righteous S'IVANA'MA‡ equal to D'HIS'ANAYA § in understanding, and knowledge of the numerous *S'rutas* ‖; who filled surrounding countries with his glorious fame . . . . . by the assemblage of his foes in battle.

24. How can the qualities of this just one be sufficiently applauded? . . . ¶ an upright, exalted counsellor . . . . he gradually so improved the government of the prince VIDYA'D'HARA, that all the sovereigns of the world were rendered tributary, and it became supreme on earth.

25. From him sprung MAHÍPA'LA, grateful to the eyes of mankind, as the moon produced from the pure sea of milk**; beautiful, of eloquent speech, who fulfilled

* The *Hindu* goddess of wisdom.

† *D'harma*, *Cáma* and *Art'ha*; or duty, love, and wealth.

‡ Minister of *Vidyád'hara*.

§ VRIHASPATI, preceptor of the Gods.

‖ The *S'ástras*.

¶ The original here exhibits '*yacapa*' which conveys no meaning: and the second syllable, moreover, is inaccurate with respect to the metre of the verse.

** The moon was produced at the churning of the ocean. The legend is well known.

the purport of his word by truth, that of his understanding by all beneficial acts, and the intent of his wealth by sacrifices, and deeds of pious liberality*. . . . .

26. Untroubled, sustaining the weighty burden of the important affairs of the prince VIJAYAPA'LA, he, whose bravery was united to irreproachable morals, became regarded as the object of comparison among virtuous ministers.

27. After him was born the learned ANANTA, of infinite excellence, capable of supporting the weight of the world; whose body was always resplendent from virtuous enjoyment. . . . :

28. His younger brother was YO'GE'S'WARA, the seat of numerous qualities, as the son† of SUMITRA', of RA'MA . . . .

29. What superiority over other men is not recorded of that righteous, magnanimous ANANTA? His ancestry had been repeatedly termed pre-eminent; he was of the illustrious *Bráhmen* tribe; he perused the *Véda*, and pure *S'ruta;* his prosperity imparted good; his prowess was ever irresistible in battle, and his speech pleasing but sincere.

30. In what affair was he, the faithful minister of CÍRTTI VARMA, not employed? His counsellor in just and important politics; his intelligence in secret and confidential matters . . . . the conqueror of foes . . . . , the sole chief of heroes.

31. If he possessed the qualities of the firmament, if his understanding was characteristic of his face, and he

* Such as, digging ponds or wells, making gardens, erecting temples, &c.

† LACSHMAN'A, younger brother of RA'MA.

was a ruler with appropriate duties, still his eminence was inferior to that of his prince. This chief continuing to give counsel, the monarch CÍRTTI VARMA . . . . by his fame, conduct, and wealth*.

32. . . . . . from the dancing of all the peacocks, who mistook for clouds the volumes of smoke † sweeping them . . . . . . INDRA, a portion of the sacrifice . . his moral virtue was reckoned abstractedly from his other qualities . . . .

33. . . . . ASARVA'‡, by name, sprung from an illustrious family, venerable from her virtuous conduct, as ANASU'YA of the sage ATRI §.

34. His second wife was born of noble parentage; well behaved, patient, and discreet . . . .

35. . . . . VATSA ‖ by name, sinless, like the dignified SUNE'TRA seated in the assembly of the gods . . . of a pure mind, correct demeanour, a sea of nobility ¶ . . . . he-roic, steady in his course, of the *Brahmen* class . . . . a treasure of excellence, a friend of the good. VA'MANA and PRADYUMNA**, ... their

* The original verse is very obscure; and I am not certain it is correctly translated.

† Arising from his sacrifices: peacocks are said to dance from joy during cloudy weather. See the *Mégha Dúta* with translation.

‡ Who it would appear was the first wife of the minister ANANTA.

§ ANASU'YA', wife of ATRI, is celebrated for her conjugal affection.

‖ ANANTA's son, perhaps, by his first or second wife.

¶ INDRA, chief of the deities, is here probably intended: I do not, however, recollect having before met with him under this title.

** The younger brothers, possibly, of VATSA.

inclinations having been ascertained, they were all employed by the sovereign ruler SALLACSHAN'A * in offices suitable to wise, just, and valiant men.

38. Now, SALLACSHAN'A VARMA . . . . again in the country of the *Antarvéd* † . . . .

39. . . . . were utterly defeated by the impetuosity of his bravery, and obliged to prostrate themselves at the feet of his master. Having cleared the country of thorns, and dissipated the fears of the people, he governed them with an increase of wealth and power.

40. . . . . having abandoned his body to the waters of the daughter of the sun ‡, the meritorious ANANTA became incorporated with the supreme. Hence the . . . . of the chastiser of his foes was employed in the guardianship § by the chieftain JAYA VARMA, who devoted his soul to faith ||.

41. Of a respectable origin, sprung from a virtuous family, spotless, possessing a clear intellect, versed in the sacred sciences, eloquent, sagacious, prudent, acquainted with the management of elephants, horses, and chariots ¶;

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* I know not how to reconcile the apparent irregularity of this mention of SALLACSHAN'A before JAYAVARMA, otherwise than by supposing their father, who may have borne this name, is here alluded to.

† The *Dóáb*, or country between the *Ganges* and *Jumna* rivers.

‡ From the context being effaced, it remains uncertain in what manner his body was abandoned to the river *Jumna*; who is the daughter of the sun, according to mythology.

§ The original term *Prátihárica*, which has been translated 'guardianship', generally signifies the office of warden, formerly, perhaps, a respectable appointment in the service of a king. Another sense in which it is used is here wholly inapplicable.

|| Meaning, probably, that he abdicated the government, and led a religious life.

¶ These were formerly esteemed high accomplishments amongst the *Hindus*.

skilled in archery . . . . mingled with affection, and other qualities. On being tried, he was afterwards appointed prime minister by the auspicious monarch PRĬT'HVÍ VARMA.

42. That wise one blessed the government of his prince with all the requisites of royalty; and was afterwards . . . . . in the ministry of MADANA, the protector of the earth. Having reduced all kings, by a well-timed application of the six expedients of defence*, he gradually extended his supremacy over the earth,

43. . . . . able likewise, possessing a multitude of excellencies, illustrious, of whom people are accustomed to say "this is truly GADAD'HARA †!" Who humbled the sea by his profundity, and . . . . even, by his understanding: is not therefore such fame solid?

44. His wife is for the procreation of offspring‡; his knowledge of the *S'ástras*, for the due performance of religious duties §; and of the *Védas*, for . . . . his wealth is for the benefit of all men . . . . from the virtues of that benevolent one, it is believed by the people that the *Cali*|| age has passed away.

45. His sons S'RÍD'HARA, VIDYA'D'HARA, and the rest, from their abilities have become conquerors of the world: hence he is esteemed the head of family men.

46. Sacrifices, and acts of pious munificence, are the

* i. e. Pacification, war, a progress or a march, a halt, or the maintaining of a post, a double resource or a stratagem, and recourse to protection.

† GADA'D'HARA is a title of VISHN'U; and it probably was the name of a son of the minister VATSA, to whom this, and the subsequent stanza, appear to relate.

‡ i. e. not for sensual enjoyment.

§ i. e. not for the purpose of disputing the doctrines they contain.

|| The present sinful age.

foundation of many good deeds: this temple, therefore, was erected, together with . . . . by that revered one . . . . the wealth of the great ought certainly to be employed in acts of piety.

47. He, moreover, with his lawful riches, caused a vast . . . . .* to be carefully made with many large stones, on the boundary of the village of *Védu*†: and on the banks of the expanse . . . . ornaments entirely of stone, not liable to be broken.

48. . . . . in a place caused to be made with a heap of hewn stones . . . . . . whose water is limpid.

49. A *Bráhmańa* named CE'D'I‡ . . . . by the skilful D'HANE'S'A§ . . . .

50. ————————————————

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* A mound of considerable extent, composed of large stones, regularly piled on each other, and placed so as to form steps down to the margin of an extensive lake, terminates at the spot where the monument was discovered. It evinces great labour, and is, I imagine, referred to either in this, or the subsequent verse. I do not, however, recollect having observed any where in the vicinity, the least vestige of the temple, mentioned in the foregoing stanza; and, as to the other public acts of the minister, which appear to be recorded in this part of the inscription, I can offer no conjecture.

† I made particular enquiries after this village, when on the spot, but they were unsuccessful. The town of *Mow* may have formerly borne this name.

‡ The poet, probably, by whom the inscription was composed.

§ The artist, perhaps, by whom it was cut.

X.

A Journey to Lake Mánasaróvara in U'n-dés, a Province of little Tibet.

By WILLIAM MOORCROFT, Esq.

INTRODUCTORY NOTE BY

H. T. COLEBROOKE, Esq.

I HAVE much gratification in being enabled to lay before the Society, an extract from the journal of our colleague, Mr. Moorcroft, on a journey to explore that part of little *Tibet* in *Chinese Tartary*, where the shawl goat is pastured; and to visit the celebrated lake *Mánasaróvara* or *Mapang*, in which the *Ganges* was long supposed to take its source.

Undertaken from motives of public zeal, to open to *Great Britain* means of obtaining the materials of the finest woollen fabric, the arduous and perilous enterprise in which Mr. Moorcroft, accompanied by Captain Hearsay, engaged, and which was prosecuted by them with indefatigable perseverance and admirable intrepidity, undismayed by the difficulties of the way and the

dangers with which the jealousy of the *Nepalese* beset them on their return, and undeterred by hardships and privations, and in Mr. MOORCROFT's instance by frequent illness, has in the result not only accomplished the primary object which was in view, but has brought an interesting accession of knowledge of a country never before explored: and has ascertained the existence, and approximately determined the situation of *Mánasaróvara*, verifying at the same time the fact, that it gives origin neither to the *Ganges*, nor to any other of the rivers reputed to flow from it. Mr. MOORCROFT, as will be seen, found reason to believe that the lake has no outlet. His stay, however, was too short to allow of his making a complete circuit of it: and adverting to the difficulty of conceiving the evaporation of the lake's surface in so cold a climate to be equivalent to the influx of water in the season of thaw from the surrounding mountains, it may be conjectured, that, although no river run from it, nor any outlet appear at the level at which it was seen by Mr. MOORCROFT, it may have some drain of its superfluous waters, when more swoln, and at its greatest elevation, and may then, perhaps, communicate with *Ráwan* lake, (in which the *Setlej* takes its source) conformably with the oral information received by our travellers.

The journal of the entire route, from their departure from the *British* frontier in *Rohilkhand*, to their return, being more copious than would consist with the limits of the volume of our researches, I have used the liberty of selection, which Mr. MOORCROFT has liberally allowed, and confined the extract of the journal to that part of the route which is wholly novel; at the same time curtailing the narrative, though with regret, for the unavoidable exclusion of many interesting passages. It is proper, however, to observe, that no other freedom has been used; and that the narrator's own words are scrupulously retained.

JOURNAL.

May 26th.—At *Jóshí-Mat'h* we left the road to *Bhadrináth*, which crosses the *Daulí* a little more than a cós above the town. At the junction of the *Vishnu-Gangá* with the *Daulí*, both rivers lose their names; and the united streams form the *Alacanandá*, the course of which has been before mentioned. As the road to *Jóshí-Mat'h* is known by the surveys of the gentlemen deputed by Colonel COLEBROOKE, I have not been very particular in describing it *: but, as the road to *Nítí* and onwards is new ground to *Europeans*, I shall follow it with more exactness.

The principal part of the minutes of our route is taken from the note book of Mr. HEARSAY, who carried the compass and brought up the rear, accompanied by HARKH DEV, and who engaged on setting out, to execute this part. HARKH DEV Pandit was directed to stride the whole of the road at paces equal to 4 feet each †.

Our road lay along the left bank of the *Daulí*, but generally at the distance of at least a cós. The road was pleasant, but the heat was greater than might have been expected, seeing that the summits of the mountains very near us were covered with snow.

The road was frequently crossed by small streams of water, of which several issue from stone conduits now out of repair. We saw people sowing the Lál Ság, or Amaranthus Gangeticus, a vegetable apparently much used by the mountaineers.

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* For the same reason it is omitted in this abridgment. C.

† The *Pandit's* measure of the road would probably have been more correct, had he been directed to step his usual and natural paces, the length of which might have been easily determined with precision by a small trial. C.

Wheat was nearly ready to cut, and lands under the plough. The ears of the wheat particularly long and bearded.

About a cós before we reached the ground for encampment we met our carriers returning, who said that they had executed their task, but had received neither victuals nor money. It appears to me that the *Chaudrí* of *Jóshí Mat'h*, who received our advances and undertook to supply the people, will keep the whole money for his own use, and press the unfortunate villagers to carry our baggage.

Some mountains near us, whose tops were covered with snow when we first came, were in the evening nearly bare.

At half past eleven reached the town of *Baragaon;* and not finding good shade went on higher, above three quarters of a mile, without being much more successful.

The cultivated lands, in the middle of which is the village of *Baragaon*, run half way up the hill, where the forest region begins with small trees, becoming thicker and higher as it ascends; and the very summit is fringed with pines, and the majestic and fine overtopping cedar *.

27th.—In the afternoon the *Negi* came to say that on the following morning he would have people to take our baggage to *Tapóban*, a village about three cós distant, from whence we should proceed onwards the following day.

28th.—Resume our journey, leaving our ground at 6^h 30′ therm. sunrise 58°. Pass by a *Sanga* over the *Daulí*, and at 3696 paces reach our ground, a little

* Pinus Deodár and Longifolia.

below the almost deserted village of *Tapóban,* placed on the brow of a hill surmounted by woods of pine, cedar and cypress*. A considerable stream falls into the *Daulí* below the village; and by the side of this is a small rivulet of tepid water.—This current mixes with the cold stream before it reaches the *Daulí,* and issues from some rough ground in the face of a rock. The heat of the water seemed to be very agreeable to tadpoles, which had deserted the colder stream to take refuge in this.

I observed a common plant something resembling butcher's-broom, which was said to be the *Setbaruá,* from which the mountaineers make a paper that is sold at *Sirinagar* and *Almora*, and from thence finds its way into *Hindústan,* although not in large quantities.—The bankers employ it for their bills of exchange, or *Húndis,* in preference to any other kind, as the ink does not sink further into its substance than is necessary to retain the writing, as it does not imbibe water readily, and relatively to its thickness is much stronger than any other kind of paper. As connected with paper, I must here observe, that the layers of the bark of birch are used by the natives to write upon, and they bear both ink and the stroke of the pencil very well. The leaves are called *Bhoj-patr*. The bark of the birch is used at *Lac'knau* for covering the wires of húka-snakes.

29th.—Settle to give Jowar Sinh 26 rupees, in full of all taxes and demands to be made upon us until we reach the frontier; for which he gave a receipt on birch paper: having previously put aside a fee of five rupees for the part he bore in the transaction. As our carriers came in a very straggling manner from the villages whence they had been pressed, we could not leave the ground till 8. At 6816 paces reach a hut taken pos-

* Probably a species of pine, as well as that which Mr. Moorcroft denominates cedar. C.

session of by our servants. This is computed to be seven cós from *Tapóban.*

After having reached the top of the first mountain, Mr. HEARSAY, who had gone before me, killed a very thin yellow snake, about 18 inches in length. I found it had the poisonous fang, but it is asserted that snakes, and all other venomous reptiles, are very scarce in this part of the country. However, on taking up the carpet on which I had slept, a black scorpion came from under it.

A warm spring, which we passed early in this day's march, issues from the rock on the right of the road in a stream of about five inches across, and three deep, and threw up a small cloud of steam. At its escape the heat was so great that the finger could not bear being dipped in it more than 2 or 3 seconds. The thermometer having been carried forwards, we were prevented from ascertaining the temperature: however no insects were in it or about it, and some plants which had fallen into it near the middle of the current, were killed and seemed parboiled. The pebbles in its bed, and the vegetable substances which were immersed in it, were covered with a yellow coat, and those which had been taken out and become dry, were likewise coated with a white earthy substance, having little taste: however, the water itself was slightly austere, and I apprehend contained iron without any other mixture. The tepid stream at *Tapóban,* which is much lower, and not half a mile distant, probably proceeds from the same source with this, and is cooled in its progress to the place at which it escapes below. I saw no appearance of volcano in this or any other mountain which I have yet met with; but many abound with minerals; and pyrites is found in great abundance.

Close to this place the road was broken by a recent

slip, and we had to pass upon the crumbling surface. The road this day was in many parts very fatiguing. In one place a slip of earth had laid bare a large surface of rock, which had been formerly covered by the road; and as it sloped to the river with a sharp descent, it required every exertion and care to guard against a slip of about a hundred feet into a current, which dashed with great force amongst fragments of marble, which in two or three points actually formed a bridge across the stream.—In another part we were obliged to climb up the face of a rock nearly perpendicular, and on which irregularities, for the toe to hang upon, were at a most inconvenient distance. My left foot having slipped off one of them, I lay for a few seconds upon the poise, but a snatch at a clump of grass, which on being seized, luckily did not give way, and a sudden spring, brought me to a comparatively safe spot, with the loss of some skin from my knees and elbows, and some rents in my trowsers and sleeves.—Sometimes points of rock projected to the edge of the river, and these were turned by rude staircases made of wood and stone.—Retiring angles were passed by inclined planes formed by a tree being laid on points of stone on each side of the angle, and loose stones were thrown from the wood to the rock. For a moment the eye could not quit the road and suffer the feet to proceed, without risk of accidents; and yet a trifling expense would render the road in general passable, although it would always be liable to be injured by the falling of the rocks above.

When we had reached the custom-house, on the middle of the mountain immediately beyond a *Sanga* by which we crossed the *Rauni*, we found one of our sircars who was detained by three men and as many women, as pledge for the payment of duties on the passage of our baggage. The receipt written upon a slip of birch bark was no sooner beheld by the most riotous of the men than he ceased to attempt any further molestation, although

it was clear that he had not read its contents.—As however one fellow was still a little impertinent, my friend insisted upon his relieving a carrier from his load, which he actually took part of the way up the hill; and then slipping from under the load slid down a face of rock, and, though old, skipped away from point to point of a rough road with the agility of a deer. As many loads were left behind, it was deemed prudent to take the third man along with us as an hostage for their safe passage. As he went along, he told us that the *Chaudri Calyán*, had farmed the customs of this place for 500 rupees a year; and that the woman, who was so clamorous, was one of his wives, of whom he had seventeen. The other two women were her slaves.

To a poor woman, who had much difficulty in carrying her burden over a very rough road, I gave a *Timáshá*, which in a few minutes was taken away from her by a man whom I supposed to be her husband. On learning that he was no relation, I got it from him, sent him about his business, and returned the coin to the woman; but when she departed, I had the mortification of observing him at a considerable distance start from a place of concealment and again force the money from her. This man was a *Zemíndar* of the village in which the poor woman lived, and though he had been obliged by the *Négí* to carry a load, he still exercised his petty tyranny over one more defenceless than himself.

The gratification of the calls of hunger seems to be the first object amongst the inhabitants of a country, which, if under a well regulated government, would be capable of exporting a surplus of provisions. At *Tapóban*, a stout young fellow offered himself to be my slave for life if I would only feed him. Although I wanted not his services, and did not much like his appearance, yet his appeal was too forcible to be resisted; and I, therefore, engaged to give him food for his services.

30th.—Obliged to halt for the purpose of collecting carriers, which was difficult, as the villages in this part of the country are small and distant from each other.

31st.—As this day my companion and myself separated, and he had along with him the compass, and the young Pandit who measured the road, I shall make extracts from his notes of the route, and afterwards notice my deviation from it. 'At 1381 paces; tops of moun-'tains covered with snow in every direction. At 2297, 'cross a rivulet which comes from E.—Snowy mountains 'in that direction quite close. At 2437, commence 'ascending the most tremendous place I ever saw. At '2783, descend to the bed of *Dauli* river, most thankful 'that I am once more safe:—I was obliged to take off 'shoes and stockings. At 7610, reach our halting 'place. Ten hours upon the march. The coolies, 'mostly women, arrived at the same time. The *Dauli* 'much reduced in breadth; but the current very strong: 'with a small exception, its general course has been to 'the S.W.'

I left our ground at 40 minutes past 5.—From the bridges across the *Dauli*, having been swept away last year, and not reinstated, a new road has been made by the goat-herds along the sides and over the tops of the mountains which overlook the river. This has been first worked into a track by the goats, and in the worst places strengthened by fragments of stones thrown in heaps somewhat imitating rude flights of steps. The path in various places formed by pieces of stone which jut out, overhangs the edge of the water, and seldom retires so far from it as to give a chance of the traveller escaping from rolling down to the river, should he have the misfortune to make a false step; and the footing was very insecure from small stones being mixed with much loose earth.—Just on attaining the summit I met a large flock of goats loaded, and was glad to find a secure corner

until the whole had passed. I observed, that goats when laden climb up places however apparently difficult without hesitation; but they do not like to go down steep declivities: for whether they descend straight down or sideways, the load urges them forward quicker than they like, and as there is no belly-band, it frequently tumbles off, and is the cause of the animal being carried down the steep sides of hills and lost.—Goats cast a look of inquiry at strangers, and pass on leisurely; but sheep generally stop, and, after one has either been driven onwards or gone of his own accord, the rest follow with precipitancy, and frequently lose their loads by their hurry.

Crossing this mountain took up an hour and a quarter. Having mounted a height, which, though short, was steep and rugged, I was somewhat confounded by the sight of a steep and bare slope of stone, about 100 feet deep, running to the bed of the river without any path, and with a surface so smooth as to excite a doubt whether I could reach the bottom in any other way than by sliding, which would have been too rapid to be safe: the more especially as the stop must have taken place amongst stones in the bed of the river. By taking off my stockings, pressing the spike of my staff into little dips in the stone, and catching at a friendly tuft of grass which occasionally presented itself near one edge, I got to the base nearly at the same time with the old Pandit, whose activity would have more surprised me had I not known that he had been bred in the mountains of *Kamaon*. Just as we had congratulated ourselves on our escape, we saw two other paths, one higher up and another lower down under a ledge of the rock, which saved the rest of our party, save two of the Pandit's hill people, from the dangers of this road.

Soon after descending the slope, I overtook a woman who had been pressed by the *Négí* to carry a load.

She said that her measure of misery was full, and that she was resolved to emigrate into *Jawár*, where oppression was not so grievous as here.

Seeing our carriers who had started about three-quarters of an hour before me, supporting themselves on the ledge of a rock, which overhung the river at a great height, by clinging with their hands to the stones on the face of the mountain, and that at length they actually stopped, I was induced to make the experiment of going round by a winding path, under an idea that I should effect it in nearly as little time as would be spent in passing over the broken path of rock. Mr. HEARSAY coming after me, and finding that the carriers preferred the short, but more dangerous road, to the long one, resolved to attempt it; and assuredly I should have done the same, had I known the length and roughness of that which I actually took. Mr. HEARSAY and a large portion of the carriers went over the rock without accident: but at one point the courage of my *khánsamàn* failed; for, on missing footing with one leg, he shrieked violently and sunk down almost senseless upon a point of stone with one leg hanging down over the abyss, calling out that he was lost. Mr. HEARSAY was at hand and assisted him most opportunely, along with the Pandit.—One woman carried four burdens at different times for her less courageous companions; and a bearer was also of some use; but at length became so alarmed as only to be capable of proceeding by being steadied by an end of his turban being tied round his waist, and the other end secured by the young Pandit as he proceeded in front.

The horrors of this road were very great, and ought so to have been to justify passing by such a road as that which I followed. For it cost me the labour of two hours to attain the top of the first mountain which I had to scale, and although the path consisted of lines of zig-

zag, not more than 10 or 12 feet in length, at angles so sharp, that in a length of 24 feet, not more than 10 feet were gained in actual ascent, yet even this progress was not made except by clinging with the hands to shrubs, roots of trees, clumps of grass, and clods of earth; and sometimes from the obliquity of the path, required me to creep on hands and knees to prevent slipping. Near the summit of the mountain, the path divided; and a mountaineer, whom we met, as we thought opportunely, at this point, advised the lower one; though from the accounts of porters and servants who took the upper one, the latter was easier but a little longer.

In descending the mountain a grand view opened from the S.E., consisting of a vista formed by two sides of mountains composing a glen, down which ran a large stream.—One slope was enriched by a forest which reached to the clouds; the other covered by scanty pasturage for about 400 yards; when it was overhung by a steep face of barren rock of immense height, and the upper part of the vale was shut up by a peak of still higher mountain, the base of which was sprinkled with cypress, and the top whitened with snow.

After a tedious march of two hours more, through a forest of cedars and cypress*, of which many would have been large enough for main-masts of first rates, I came to a *Sanga* across the stream which ran down the valley. From this point I ascended the hill surmounted by the bare sheet of rock, by a goat path, and had to cross an avalanche which was scarcely settled; every now and then a piece of stone rolling down its face and bringing with it currents of earth. The path was narrow, occasionally going over a surface a little rounded, which, in some slight degree masked the tremendous declivity below, and sometimes skirting its very verge. At one spot,

* Pines, see a former note.

on a ledge of rock, the old Pandit hesitated and retired into a hollow. However, having the advance, he summoned up courage, and passed the cause of his fears; this was formed by an angular piece of rock having slipped out of the ledge or cornice on which we were walking; and a piece of stone, which just, and only just, rested with both ends on the opposite edges of the gap, shewed a precipice of a depth sufficient to alarm the anxiety of a person who had not been much accustomed to the mountainous paths of this country. After clambering over fragments of stone which had fallen from the heights, we came to a point of rock, whence we had a complete view of the declivity over which we had to pass; and this part was to me more difficult than any other. However I reached the bottom of the hill without injury. I learnt that I had gone 4 cós, and had not made above half a mile of head way. From the fatigue of this detour, I was so enfeebled as to be under the necessity of halting five or six times in ascending a steep mountain, and obliged to creep on my hands and knees for a great distance, not having sufficient confidence in my legs. My knees tottered, and I was frequently attacked with such a violent pain in the right knee, as for a second or two almost deprived me of the use of the limb. I much suspect that I had lost my road. In creeping along I certainly made a wrong choice, as I found myself at once upon the brink of a precipice, on the very angle of a rock which overhung it, and a slit in the stone shewed me my danger at the very moment I was about to place my hand upon a fragment which the weight would probably have dislodged, and carried me along with it; at this moment the recollection of the danger produces an involuntary shiver.—After some time I got into a tolerably good path, and found my companion, and the greatest part of the party, waiting my arrival by the side of a cool stream of excellent water.

The latter part of our march was not good: but this

road, although almost every where else it would have been deemed impassable except for goats, was good in comparison with that which constituted the labour of the morning.—This has certainly been the most severe day's work we have had; and yet I compute the actual distance, including the 4 cós of detour, cannot have exceeding 13 cós.

The ordinary road is not particularly difficult or dangerous; and all the risk of life which I have mentioned, inconvenience to the inhabitants of the country, and impediment to commerce, are created for want of *Sangas* which might be made for 100 rupees: but the present government does nothing to ameliorate the state of the country, or to increase the happiness of its subjects in these districts.

June 1st.—Commenced our march at 7-30. At 2345 paces the river becomes a succession of rapids, and has its channel diminished to about 20 yards in breadth. At 3407 paces we pass two caves, a small and a large one. The *Dauli* about eighteen yards broad. At 10,971 paces come to some cedars* and halt. The *Dauli* much reduced.

At our place of encampment, a black scorpion was brought, and was said to be harmless: however on pulling off his sting and pressing it, a large drop of a thin milk-coloured fluid escaped from its point.

On the top of a high mountain, thinly sprinkled with worm-wood, dwarf cypresses*, and a kind of furze, blocks of marble and hard stones were scattered about in every direction, which seemed to contain minerals; and I am much deceived, if I did not see some veins of

* Pines.

silver * in strata of quartz. I had no instruments to break stones with, nor did I see any small fragments which I could with convenience place in my girdle. I was obliged therefore rather to leave this point unsettled, than to expose myself to the suspicion of coming into the country in search of precious metals. The surfaces of many of the hardest stones, on this side of the *Paie-kandé*, are studded with small red crystals, which project; at first view, one is disposed to take them for garnets; but they are not transparent. They are so firmly imbedded in the substance of the stone which serves as matrix to them, that they cannot be raised by any common instrument in a perfect state, so that I could not count their faces.

The scenery of this day has always been wild, and in some places most imposingly majestic; especially from the side of the mountain where we halted. On every side the view is bounded by summits of mountains peaked, rounded, broken into ascending and descending lines, with abrupt ragged dips, and a few soft hollow sweeps, but all covered with snow. The declivities in some parts thickly covered with cedars and cypresses †, in others thinly sprinkled, and in others diversified by bare patches of rock or sand. The base of two lines of mountains is washed by the *Dauli*, which runs with great rapidity and noise, about 400 feet below our encampment, in a space only just large enough to receive the water which it now rolls along the channel. One slope of the hill immediately before us has been broken from top to bottom by a slip which has only lately happened. In its course it has overwhelmed large trees, of which some have been hurried into the river, others lay across its bed half buried in rubbish; and others, thrown down, hang by their roots with their heads towards the base of the mountain. The devastation committed by large slips, is sometimes very

* Perhaps Mica. C.
† See a former note.

great, and they frequently happen : for I have this instant heard a tremendous crash at a distance produced by a fall of rock, and was awakened by another at a moment that I had lost all sense of fatigue under the shade of a large mass of stone.

When the structure of the exposed faces of mountains has not been entirely broken, I have remarked, that the general direction of the component layers has been to the E. of N. with an inclination towards the horizon about the angle of 45°.

We pitched in an open space between two ranges of high rocks. At the foot were some large cedars *. I measured one at six feet from the ground, twenty-two feet in circumference.

This evening the report ran, that a carrier had fallen off the first Sankho in this day's march, into the river, with his load, and was drowned.

June 2d.—March at six with the same coolies. In one place the river is covered by masses of rock, under which the current rushes with great violence. At 350 paces we cross to the left bank of the river over a Sankho, consisting of three parts, in consequence of two blocks of stone having fallen into the stream and formed three channels. It was in good order and thirty paces in length. At 4680 paces cross a broad large brook, in which there are large beds of frozen snow, with a stream of water running beneath them ; and immediately on the right bank of which is the village of *Malári*.

The road of to-day has exhibited much variety ; and a short account of its features will convey a general idea of those of this country. At first we passed over heaps

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* See a former note.

of fragments of rocks; afterwards over beds of pebbles; then ascended a mountain partly by a path worn in the earth by frequent treading, and partly formed by the surface of rocks and by stairs: where the road on the face of the rock shelved much to the river, a few loose stones were laid upon it close to its edge; and sometimes earth was thrown amongst them, or a few pine branches were placed along it and loaded with stones: this served as a kind of defence or parapet: but, as they were never higher than a foot from the level of the shelf, they would only stop a slip of the foot. Where niches were broken out of the rock in the line of the path, and formed gaps over the precipice, if only of small extent, a piece of wood was laid across the widest part, and slabs of such stone as was at hand laid from it to the rock, either supported by a ledge, or if the face of the rock chanced to be smooth, on another spar of wood.—Where the gap was very wide, the trunk of a large tree was put across; the upper side being cut a little flat, or else having notches hewn in it as stepping places; an open space being left between it and the wall. Commonly these trees or Sankhos over chasms, as well as those Sankhos across rivers, are tolerably well guarded against turning, either by being weighted with large stones at each end, or by having rude stone wedges driven through two holes at each extremity of the trunk or plank.—Where the chasm is too long for a tree, a heap of flattish stones is placed in the nearest part, which affords room for the base of a flight of steps, constructed sometimes of stones wholly, sometimes of stones supported in front by logs of wood: but no railing is to be met with any where; and from the general looseness of the mode of building, these roads are subject soon to get out of order; but, if the stones be large and the base flat, this kind of stair lasts longer than might be expected, as the passengers walk with care. Slips from the hills do most mischief to them, and their course being almost always at the foot or on the side of mountains, exposes them to constant injury in some part of their extent.

To-day I had just crossed the slope of a slip that had happened last night; when I heard a little trickling above, which rapidly increased, and was caused by a shower of small stones, of which some slid easily over the surface of the falling earth, but others, having got a little momentum by rolling over perpendicular breaks, dashed down with such force, as would have been fatal to any animal which they might have chanced to strike in their fall.

As Mr. Hearsay was following the coolies, three bears, which were scampering up a steep gulley, that had been a water-course, but was now half filled by sand, earth and stones, displaced stones about 300 feet above the road. These in their descent loosened others, and dashed across the road while the coolies were passing, but fortunately struck no one, except one of my bearers upon the leg, and he was more alarmed than hurt.

The view of the village of *Malárí* from the top of the hill, where it comes in sight at a distance of about a mile, is pleasing, and would give a good effect on canvass. It is placed in the eastern angle of a triangular plain about a mile on each face, and bounded on two sides by streams, and on the other by steep hills, covered up to their summits with a bed of snow, thin on the projecting parts, and deep in the ravines. The southern stream is half choked by banks of frozen snow, through which a mountain current, formed by spring-water and melted snow, forces its way, undermining the masses of congealed snow, which now impede its progress; but which in two months will be dissolved and carried into the *Dauli* that runs with impetuosity from the north to the west.

The extremely neat state of the land recently sown principally with *Chéná**, and separated into fields by

* Panicum Miliaceum.

recently piled stone fences and living hedges, would do credit to any country; but the proportion of cultivated to uncultivated land in this country, at present, is almost as a drop of water to a large river.

The village of *Malárí* consists of about 20 houses, built of rough stones, cemented with clay, and mixed with much wood. Many are of one story, but more of two, and some even of three stories. The lower range is generally given to the cattle. Circular stones, with holes through the middle of them, are hung by ropes to the projecting ends of the beams at the gables, to prevent the roof being injured by gusts of wind which are here frequent and violent. The upper story projects generally beyond the lower one, in consequence of its being furnished with a wooden verandah, which commonly runs along both sides, and is made of fir plank in strong pannels, ornamented with flowers and figures of *Hindu* deities, amongst which GANE'SA is most frequently represented. There is no lock, bolt, or latch to the doors, but in one door-post a square hole is cut, through which a rope is past, that ties a dog to it, who guards the entry with fidelity. His collar is of wood like a yoke collar, and a stick is tied to it, and likewise to the rope which holds him to the door.

Málarí is inhabited by a class of people who call themselves *Rajpút*, but appear to pay little attention to caste. The poorer class of inhabitants of the frontier eat raw meat with a little pepper and salt as seasoning; which we had an opportunity of seeing; for the leg of a goat being thrown away in consequence of being tainted, the coolies instantly seized it, and made apparently a savoury meal from it. Both men and women are rather of low stature, but not ill made, and have something of the *Tartar* countenance mixed with that of the *Hindu*.

They dress in coarse woollen cloth made from the

fleece of their own sheep, and of those of *Bután*. The women alone weave, sitting on the ground, and are very industrious and expert. In five days, with a very simple apparatus, a woman will weave a piece of cloth about 18 inches broad and 15 cubits long. This is called a *Pankhí*. Some of them are flat, but others are twilled and very strong. They are worn without being bleached or dyed. The proportion of females seems much greater than the males. This may be accounted for by part of the male population being taken by the *Nepalese* for their army, and by another part being engaged in going from the upper to the lower hilly district, to sell salt and bring back grain. The dress of both men and women is generally over-run with lice; and their persons are, with few exceptions, disgustingly filthy. The inside of the house is no less filthy than the dress of the inhabitants; and as no other articles of furniture are to be seen in them than benches and cooking utensils, one might be led at first sight to believe, that the inhabitants laboured under the pressure of the severest poverty; but this is not the case, as is shewn by the ornaments of the women; and it is probable that they avoid making a display of wealth, lest it should be taken from them by the *Gorkhiahs*; to which may be added the circumstance of their inhabiting this country only from about the 24th of May till the 23d September, when they migrate to the villages of *Tapóban*, *Baragaon*, and other places to the N.E. of *Jóshí-Math*. These people, from living half the year in one country and the remainder in another, are called *Dóbásás*, and also *Marchás*; which latter appellation gives a whimsical affinity in situation and name to the former inhabitants of the borders of *England* and *Scotland*. They carry on a considerable trade between the inhabitants of the *U'ndés* and those of the lower parts of the hills. From the former they procure borax and salt, which they either carry to the frontier of the Company's possessions, or sell to the inhabitants of the hills, and take back to *Bután* grain in exchange. This commerce

produces a profit to the *Marchás* of at least a hundred per cent. on the grain, and about 150 or 200 on the salt: but can only be carried on during the six months of the year when they reside on the *Bután* frontier: and as they load goats and sheep with the merchandise, these feed themselves wherever they stop; and, as great flocks are driven by two or three people, the transport is attended with little real cost to the *Marchás*. But the commerce of the present day is said to be a mere trifle in comparison with the traffic of former times. The goats used for this business are of the breed of this country, migrate regularly twice a year, are short-legged, of a strong compact form, and travel about 5 cós a day over the most rugged and difficult roads that can be imagined.

The principal articles of the food of the most wealthy consist in the morning of boiled rice and goats' flesh, and at night of cakes made of wheat-flour beaten with water and seasoned with salt and clarified butter; as also of curds and fresh milk of sheep and goats. But wheat-flour is scarcely ever tasted by the poor, who live upon the coarsest and most common kinds of grain; and, when they can get it, eat flesh raw, as has been before observed. Wheat is not raised in this district, but grows to a good height near *Jóshí-Math*. The following grains are raised here:

1st. Chuá or Marcha; resembling the Amaranthus Gangeticus, or Lál Ság of the *Hindus*; used here both fresh, and in its seed when reduced to flour.

2d. Manruá or Manrwé: Cynosurus Coracanus.

3d. Phaphei.—This looks a little like *French* wheat.

4th. Coarse red rice.

5th. Ana Jau.—I have not seen this growing, but the grain unshelled looks like barley. Shelled, like a poor kind of wheat.

6th. Barley.

7th. Chání or Chéná. Panicum Miliaceum.

8th. Kangné. Panicum Italicum.
9th. Jangorá.

Slaves are much employed; and are bought from the *Gorkhiahs*. In the evening my fakir harcárah, with a real fakir, arrived with intelligence that one of the women carriers, who had followed the circuitous track I had taken on the 31st, being much fatigued, went to the river to drink, and placed herself on a large stone, which slipping, caused her to fall into the water. The rapidity of the current was such as to hurry her out of her depth, and she was drowned. This matter affected me considerably. On inquiry I found she was without a family.

June 3d.—Leave *Malári* at 9 A. M. At 6165 paces, reach our encampment. The quantity of common and lemon thyme near water-courses was very great, but none of it had been cropped by sheep; I also saw basil, savory, mint, and other potherbs, with sedums of several kinds; and I likewise met with some gooseberry-bushes.

June 4th.—After breakfasting in a cave, at the foot of which runs a clear rill down a deep and broad rivulet half choked with a body of frozen snow, we left our ground at 7¼ A. M. After proceeding 5145 paces, arrive at the village of *Níti*. In the latter part of this day's march I found my rate of breathing quickened beyond its natural standard in proportion to the difficulty of ascent, and was obliged frequently to stop, in order that the action of the heart might become less violent. My companion has been aware of occasional oppression in breathing for the last three days; but I did not experience any till this day. The very wretched appearance of the 14 or 16 houses, which compose the town, gives no favourable expectation of the supplies we should here meet with.

June 5th.—The situation of *Níti* is in itself pretty

enough, being at the foot of a small sweep of hills which defend it from the N. and W. A gorge, between the Western hills and those to the South, gave entrance to the *Niti* river; and the valley is shut up, about a mile to the E., by an ascent covered with birch trees, and leading to many gorges and ridges of a high mountain topped with snow. Down the side of the mountain, immediately in face of the town and extending from top to bottom, winds the track of a recent avalanche looking like a new made turnpike road. In front of the town, and between it and the river, are a few flats, which descend by steps, and have lately been ploughed. The town, following the line of the base of the rocks, was originally built in a crescent, but many of the houses have been deserted and unroofed, and now serve only as night stable for cattle.

We sent a message to the *Sehána**, importing that we should be glad to see him. The meeting took place at our tent; and the *Sehána*, whose name was ARJUN, began by stating that this was a road which pilgrims to *Mánsarówar* seldom came; that we were armed; that we had many people; that report said we were either *Gorkhalis* or *Firingis*, come with designs inimical to the *Undés;* and that measures had been taken accordingly. We endeavoured to remove these unfavourable impressions; and after much conversation the old man seemed satisfied. We wrote a letter in *Hindustáni* to the *Déba*, informing him that for pious and humane purposes we wished to visit the lake of *Mánsarówar;* that for defraying our expenses we had brought certain articles from our country for sale; that we had for our own defence certain arms which we were willing to leave in his keeping during our stay in the *Undés*. On urging to the *Sehána* the necessity of our speedy departure, he observed that the snow was not yet sufficiently melted;

* The head man of a village is called *Shána*, or *Sehána*, *Seyáná*.

that the communication was never attempted before the *Sancránt*, or entering of the sun into the next sign; and that this would happen in fifteen days; when they would accompany us, in case the answer of the *Déba* should be favourable to our intentions. The argument of the road not being open was falsified by the appearance of the *Unias*; but it was thought best to wait an answer from the *Déba*.

From the 5th to the 9th, the thermometer at sun-rise has been generally at 46°, but in the middle of the day about 72°. The nights have commonly been clear and serene, but there have been a few slight showers of rain in two of them. About nine it becomes pleasantly warm; at noon it is sultry; about three the heat generally and suddenly subsides, and the tops of the highest mountains are enveloped in clouds, which deposit their contents on them in the form of snow, and in very gentle showers of rain in the valley of *Nítí*. The changes in the temperature of the atmosphere are very sudden and severe*.

* On a subsequent day Mr. MOORCROFT observes "*June 12th.*—The temperature of the air varies much in the course of the day and night. At sun-rise, the thermometer is from 40° to 50°; in the middle of the day, from 70° to 80°. At eight in the morning the sun overtops the hills which surround the little valley of *Nítí*, and blazes with a fierceness of which we were the more sensible from the cold of the morning. About three the heat falls off most rapidly. I have never before experienced so sudden a transition from heat to cold, and contrariwise. At night I am only comfortably warm with almost all the bed clothes I can muster. At sun-rise a thick coarse woollen *Hindustani Chapkal* or wrapping gown, over shirt, cotton waistcoat, and double cotton coat, is only just sufficient to keep out the cold. At nine the outer coat must be thrown off; at ten it is desirable to get quit of the other; and at noon the rest of the garments are, to say the least, incommodious from the heat. The reverse of this progress becomes necessary from half past three till night. The frequent changes of the temperature produce colds and fevers both amongst the inhabitants and strangers: but, though rather active in their symptoms, they are neither dangerous nor of long continuance. Ordinarily from the morning till about three o'clock, there is an upper and under current

In the morning the summits of the highest mountains are wholly concealed by the snow: about noon the ridges between the ravines are cleared, but it remains in the clefts and gorges: and from three to the following morning the mountain has a new covering. This successive deposition and melting go on during the warm months. But, in the cold weather, when the mountaineers are obliged to quit their habitations, and leave them to be taken possession of by such wild animals as prefer them

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in the atmosphere. The clouds are generally white during this time; move briskly towards the north, and change their forms with much vivacity. Their speed is commonly checked as they approach the most lofty mountains, to which they decline, and if they do not come so much within their influence as to burst upon them, they regain by degrees their former course. But about three the clouds become more murky, are stationary, envelope the summits of the mountains, and roll down their sides, discharging their contents in the form of snow upon the highest, and in light showers of rain upon the lower ones. The lower current is formed by the interruption given to the under strata of the higher current by the irregular form of the land beneath, and is almost continually varying in direction. During still nights the dew falls very heavily; but, when there is a little motion in the atmosphere, the humidity is suspended above the valley and attracted by the hills. The stars are very brilliant, and the north star is beautifully resplendent.. A bed of clear light-coloured air in the darkest night overhangs the summits of the peaks which are covered with snow. Once only lightning has been observed; but, there has been no thunder during our stay. Does the great height of the mountains carry off the electricity of the atmosphere, before it can be accumulated in quantity sufficient to displace a body of air with the violence necessary to produce an explosion? I regret that we have no means of measuring our actual height above the level of the sea. All of us feel much inconvenience through it being necessary to breath very frequently, even when going as slowly as possible upon an easy ascent. We anticipate great fatigue from this cause on scaling the stupendous heights over which the road lies. The natives recommend a small quantity of coarse sugar to be eaten whilst we are mounting, and speak highly of the power of the kind of spar found near the snow reduced to powder and mixed with water, in diminishing the distressingly quickened action of breathing. This spar they believe to be snow gradually melted and again condensed and crystalized by continual cold, and call it *Himgal* from *Him*, snow; and *gal*, from *galána*, to melt.

to taking an asylum in caverns and glens; the whole surface of the valleys, as well as mountains, is richly covered with snow, which in some parts melts under the influence of heat and rain, but in others remains continually. This mass of melted snow on the vast ranges of mountains forms the great rivers which proceed from them.

When we arrived, the *Níti* river, about ten yards broad and from two to four feet deep, sent down a rapid stream of greenish but clear water. The two following days were very hot: the stream was on the 3d, at least a foot deeper, and considerably broader; and the water is clay-coloured and turbid. I have frequently observed, that the water-mark early in the morning upon the stones in the river was a foot and even eighteen inches above the level of the stream at that time of the day, and that the river always rose considerably towards the evening. This is easily explained by the cold of the night produced by the snow on the mountains suspending the melting process, and of course interrupting the supply until the heat of the following day quickens it again. Such a surface of mountainous country, in such a state, along with the vast declivity of the beds of the rivers, will afford a more satisfactory explanation of the real sources of the *Ganges* than the deriving it from a lake which must have some continual source of supply itself.

The birch trees upon the sides of the mountains, as well as the small rose-bushes, are just breaking into leaf; the furze is just coming into blossom. The natives have some barley, of which a few blades appear, and they are engaged in getting into the ground the *awa-joa*, *pháphar*, and *chua*. This is, it is presumed, their spring; and our rains must be their summer, as their harvest is cut before the middle of *September*, when the people go in search of a milder climate.

This morning (the 9th) I saw a beautiful crop of rock

crystal shooting out of an exposed layer of quartz which had formerly been a vein in a mass of very hard stone. These mountains, which are primordial, would, if examined by an able and careful lithologist, throw great light upon the natural history of the mineral kingdom; for here, at almost every step, he might come in sight of the surfaces of rock which have never been altered by the hand of man, but have alone been subject to the laws of composition and of destruction, induced by the operation of natural causes.

With the exception of grain of various kinds which is to be obtained at an exorbitant rate, little eatable is to be procured at *Nití*. The only animal food, which we have had, has been two or three lean goats. There was no want of kids or lambs; but the owners would only sell such as were ill or extremely old. This country at the present season gives no fruit. The inhabitants have no gardens, and the only esculent vegetables, which we could find, were the *Bathua* (Chenopodium album), a small quantity of self-sown *phúphar* about three inches high, and some rhubarb, the leaves of which were only just springing from the ground; yet, even in this early state of vegetating, the flowers were thrown out on the sides of short finger-like processes and yielded a sweet smell. The vital principle seems to be most rapidly called into action amongst the vegetables of this climate to compensate for the long period during which they remain in a torpid state. Our diet was certainly of a very frugal kind, and would not have been considered luxurious even in the cell of an anchorite: but our beverage was water of so excellent a quality as to make up for the scantiness and uniformity of it. We had been promised by the Pandit, that we should have an opportunity of seeing and probably of killing some *Barals*. The first part was verified; for they made their appearance amongst the furze bushes, almost immediately above our heads, and at the foot of the bare rocks; but never came within gun

shot. Although we were told that the richer *Marchás* sometimes ate animal food, I believe that this occurs very seldom. They are much subject to fevers from derangement of the intestines, brought on from vegetable diet little seasoned; and several have the *Gegha* or *Goitre*.

13th.—This day two *Uniyas* arrived at *Níti* with a letter to the *Siháma*, which neither they nor he could decypher. However a meeting was held upon the substance of the message, which they brought, by the head persons of the principal villages in this neighbourhood. The letter was supposed to be a formal rejection of our desire to enter the country. This conclusion was drawn from the refusal of the *Déba* to accept our present, and from the verbal notification to us of the decease of the *Lama*, and of large bodies of troops having been detached to all the passes leading from the mountains into the *Undés*, to prevent the entrance of any white people, or persons wearing white clothes, into the country, until after the election of another *Lama*. This message was, of course, very disagreeable to us: however we were resolved not to return without having made every effort in our power to succeed in our original project. The people of *Níti* confessed, that they were alarmed at the reports which had been circulated respecting us, previously to our arrival: but, that on seeing more of us, they had sent a *Fúniá* or *Vakíl* to the *Déba* of *Dábá*, stating that they believed we were men of character really intending to go to *Mánsaröwar*, having merchandise to dispose of, and not harbouring any evil design against the general welfare of the country. We knew, that the *Vakíl* had been dispatched two days subsequently to the departure of the first two *U'niyas*; but we placed little dependence upon the impression he would make. The commencement of his mission certainly took off much from the accustomed dignity of his post; for, in attempting to ride upon a bullock, he with difficulty mounted, in

consequence of being very drunk, and fell off four times before he was able to reach the top of the mountain.

16th.—Another great meeting took place. The *U'niyas* insisted upon our not being permitted to pass; and the *Seyánás* of *Nítí* and *Gomasalé*, ARJUN and GUJAR MALL, were decidedly against us, especially the latter. HARDEB was sent back with money to the brother of NATHU, a relation of RAMKISHEN, *Seyana* of *Malárí*, who had shewn an inclination to assist us, to bring bullocks immediately, that we might attempt proceeding by the road of *Kieulang*, and we laid in ten days' provision for all our men, in order that we might not lose any time at *Malárí* in collecting it, RAMKISHEN acquainted us with the opinion of the council, said he would hasten all our operations at *Malárí*; and HARDAB was ordered to bring a *Jowárí* (who had made an offer to us of conducting us in three days from *Málarí* into the *U'ndés*) with promises of safe conduct to *Nítí* and back, and of reward for his services. Hopes were entertained, that in some way we should still succeed by persuasive means with the people of *Nítí*. However, we thought it right to take all such measures, as might appear likely to gain our point without loss of time.

Another meeting was appointed two days afterwards at *Gomsalé*. In the course of this morning two persons had come from *Negí* BHAWANÍ SE'NA, with a letter requesting the loan of one hundred and one rupees, to be repaid either in carriage of articles, in provision, or in specie, with interest at 2 per cent per mensem, and a bond for the amount, along with a statement of the prices at which we should receive provisions. He said, that he understood we were delayed, and advised our getting on quickly.

In the evening AMAR SINGH, the son of the *Seyana* ARJUN, declared to the Pandit, that, if we would place

confidence in him, he would take our baggage to the frontier, would make an arrangement with the *Déba* by becoming surety for us, and would go with us to *Mánsarówar*, after which he would settle in *Jówar*, as he was apprehensive, that the *Negí* would have recourse to some harsh measures with him, in consequence of his quarrelling with JOWAHAR SINGH, and causing his servant to be beaten. He said if the council at *Gomsalé* were friendly, it would be well; if not, he had five bullocks, and would see what was to be done in respect to the further number required. His father was convinced, that we were persons to be depended upon, and was privy to the transaction. As it seemed on many accounts preferable to take the *Dábá* road, the old Pandit on our part went to the father and son in the night, to take their oaths for the performance of their covenant. The next day HARDEB returned with an account of NATHU's brother having repented of his declaration, of RAMKISHEN's slackness, and of his not being able to purchase any bullocks although at double their value. It has been agitated whether the *Seyanas*, altogether, shall become sureties for us: but as yet this motion has been negatived. Once it was proposed, that we should leave our property at *Nítí*, and go on with clothes and provision alone. This was, of course, rejected by us as ridiculous. It was then submitted, whether we would allow them to take it and sell it whilst we should stay for the proceeds.—This was rejected likewise, and we declared our determination to march alone if they would not assist us with cattle.

The *Fúnia* arrived on the 19th, and by him it appeared clearly that it depended solely upon the people of this country to give us an introduction; for the *Déba* said he hoped the *Nítí Marchas* would not give us carriage, observing "if they have not conveyance for their baggage and provision, they cannot come; but if provided with carriage, as there are no troops hereabouts, there is no method of preventing their entry into the

country." The *Fúnia* also hinted, that a moderate present to the *Déba* would overcome all difficulties.

22d.—AMER SINGH says that we shall certainly break ground to-morrow; but as yet we see no preparation, save amongst ourselves.

23d.—Still difficulties are started against our proceeding, until there shall be a general consent of the heads of villages, to enter into a security for our good conduct with the *Déba* of *Dábá*. We have had no small degree of difficulty in causing ARJUN to fix terms for the hire of his cattle. At length we have fixed, that each bullock shall carry the accustomed loads of two men, and not exceed five rupees. Understanding that all the people concerned in our affairs were drinking at ARJUN'S house, we made a bottle of brandy into a kind of punch, well sweetened, and sent it, in hopes that its influence might be beneficial to our cause; in the opinion of the party it had only the fault of being too limited in quality.

24th.—We were disturbed during last night by the shoutings of men and almost continual barking of dogs. Two large bears had broken into a sheep-and-goat-pen, and carried off one of the goats.

We rose at a very early hour to prepare our baggage for loading, as nine bullocks had been brought to *Níti* the night before; but after being ready for two hours without AMER SINGH or any of his people coming, we sent word that we wished to proceed. This brought old ARJUN, who desired us to delay our journey three days longer, when every thing should be ready. His reasoning was very unsatisfactory, and we urged him to fulfil his contract. In consequence of our remonstrances, he promised that we should begin our march to-day even if GUJAR would not consent, although he was particularly anxious to obtain his concurrence to the measure. After

waiting another hour, GUJAR made his appearance and made many objections to our journey. He, GUJAR, received a present of ten rupees, but I had reason to believe that he expected more. ARJUN had five, and we had friends amongst the women, in consequence of medicines given to them, as also of silver rings and other trifles, which I had distributed. After a delay of two hours more we took our leave of *Nítí;* my companion and myself then mounted on a *chounr* bullock*. We were told that the first march was to reach *Gútang*, a place five cós distant, where we were to halt two days. This compromise we were really happy to make, for it was evident that it was the intention of the people to detain us at *Nítí* as long as possible, for objects of their own.

Left *Nítí* at 11^h. 20′. After travelling a mile, the people would not go any further, saying they were not prepared to proceed to *Gútang*, and that they would be with us the following day. They wished to solemnize the anniversary of the death of one of the villagers which happened by accident twelve months ago, and their march to *But'hant (Bootan)* at the same time; and, notwithstanding their promise, it was understood, that they would take up two days in this festival.

Our encampment was on the slope of a hill, situate between the foot of high mouldering mountains and the river *Daulí*, not farther than a mile in direct distance from *Nítí*.—However, we had made a start, and were in a better posture for defence, in case of any attack being made upon us, than at *Nítí;* for in front of us there was a deep rivulet; on our right, looking towards *Nítí*, whence only we had any thing to apprehend, was the river *Daulí*, and, on the left flank, mountains which could not be turned without immense difficulty.

* The Yak of Tartary. Bos grunniens.

25th.—Rain fell during the night, and, as the cattle had been turned loose to graze the preceding day, I resolved to go towards the rocks. We had heard the call of birds, which we took to be pheasants. I was three hours in reaching the base of the line of rocks, which seemed not quite three miles from our encampment; and though I climbed as slowly as possible, I was obliged to stop every five or six paces to take breath; and the persons who accompanied me were affected in the same manner. In respect to game my search was unsuccessful, but I met with many plants; amongst others were two kinds of rhubarb.—One I took for the Rheum palmatum, the other was much smaller. I cut up the roots of many large plants. The leaves in several instances sprung from a little sound bark, which surrounded a large portion that was rotten. Those, which were hard, were detached from the sound part of the bark near the surface of the ground: but these shrunk much in drying, and had but little of the rhubarb taste, colour, or smell, whilst the sound fragments of the root of the preceding year were marbled like the cut surface of a nutmeg: some were yellow, and had the peculiar qualities of the rhubarb, with a very large proportion of a bright colouring matter which stained the finger of a gold tint: but I presume, that the best time for taking up the roots is in *September*. If the quality of this root should be found to equal that of the *Levant*, the quantity procurable here at an easy rate would be very great.

We have learnt, that the carousals of last night were kept up so long as to have prevented the partakers from undertaking any kind of business.

26th.—Early this morning I went up the mountains. The ascent was very laborious from the great difficulty of breathing which we all experienced; yesterday, out of five people, two only were able to go as far as I did; today only one out of four could keep company with me;

and he requested me to return, as the cold made him suffer much. The wind blew fresh up the mountain in the line of direction which I was taking: but I found, that I could not take above five or six steps straight forwards, without stopping to take breath; I, therefore, ascended by zigzags of eight or ten paces, which afforded the opportunity of having a side wind in each oblique line. After a toilsome ascent of five hours, I reached a small flat of table land, which, if alone, would have been considered as of great height; but was of minor importance in the presence of rocks of such stupendous loftiness, as those which hid their summits in the clouds. This was covered with a dark green carpet formed by a short narrow-leaved grass of a springy nature, and enamelled with small blue polyanthuses in tufts, with anemones and ranunculuises, but not with any of remarkable brilliancy of colour: after collecting all the varieties within my reach, I prolonged my march, following the track of a *chounr* bullock up the hill. I was obliged to continue my oblique march; but, on turning my back to the wind, felt a sudden fulness in my head accompanied by giddiness; and fearing apoplexy, I threw myself on the ground with precipitation. After a short time the gasping for breath became less frequent, the action of the head was less violent, and I quitted the turf; but although I walked as leisurely as possible, I was twice again attacked with the same symptoms, and thought it most prudent to desist ascending any higher. The imperious necessity for stopping to breathe at every four or five steps was only felt whilst ascending; when the impetuous action of the heart was reduced by remaining quiet in one place, no difficulty in breathing was perceived, nor was it felt in descending, even in a run, where this was practicable: but several times at our encampment, when about to fall asleep, I have been interrupted by the same sensation. Although not particularly aware of any remarkable degree of heat or of cold, yet I found my hands, neck and face very red, and the skin sore, and blood had

burst from my lips: a circumstance which I do not recollect to have happened to me before.

27th.—Hearing nothing from the *Nítí* people, a messenger was dispatched to learn the cause of their not coming. He went off about ten in the morning, and said that he found all the inhabitants fast asleep from the effects of intoxication. Men, women and children were lying in one promiscuous heap upon the floor—with difficulty he awoke two people, who stated that ARJUN would be with us in the evening, and that we should assuredly march the following morning. They had killed several goats, and burnt the entrails, and some other parts on an altar, but had feasted on the remainder. When a person dies, it is customary to invite all the relations and friends of the deceased to a supper and dance. The night is spent in feasting and drinking at the expense of the property of the deceased; and not unfrequently, the revelry is attended with bloodshed, as was the case last night, three persons having been wounded with swords.

In the evening ARJUN came, and promised that we should start in the morning; but desired to have a bond of indemnity against any mischief that might be done by any of our party in *U'ndés*. This was complied with, we promising to pay five times the amount of any damage done.

June 28th.—Thermometer 51½, depart at 7 A.M. At 3605 paces cross melting snow. At 5917 came to our halting ground on the bank of the river. This is called *Gútang naclí*. Here we found the goats and sheep belonging to the *Marchas* of *Ghomsálí*, *Pharkia* and *Nítí*, who are going to *Bootan* with grain. Two P.M. thermometer in tent 74°. In the evening AMER SINGH and GUJAR's son arrived. Rain continued great part of the night.

29th.—Thermometer 50°; morning cloudy and rainy. Leave our ground at six A.M. At 1560 paces the *Daulí* is joined by the *Hiwangal*, which rises from the *Nar-Naráyan* mountain of *Bhadra Nát'h*, and is a considerable stream. The joint stream is about twenty-five yards broad. Proceed over blocks of stone along the left bank of the *Daulí*, which hurries down its bed a great body of snow water. At 2370 paces a bed of snow forms an arch, under which the river runs: this bed was about forty yards long and ten thick. At 2680 paces arrive at another, over the edge of which we proceed. At 3109 paces reach another, which like the former passes over the river. At 3580 paces cross on a *Sankho* to the right bank; river about sixteen feet broad but rapid; ascend a difficult hill. At 4630 paces reach its summit. This is the road for the early part of the season; at a later period the best road is along the right bank of the river. The stream is about 700 feet below the top of the ascent just mentioned. At 7350 paces cross a broad water-course called *Patarpání*, proceeding from the mountains, and carrying a considerable body of water, due E. into the *Daulí* about a mile distant. On the other side of the river another water-course coming from the E. by S. empties itself into the great stream.

We had been obliged to comply with the extravagant terms of the *Nítí* people at the rate of fourteen *Timáshás** for every load, and a bullock was rated at two loads, that is twenty-five *Timáshás*; we wished, that there should be a stated weight: but this they would not comply with, and a cow was entered as being equal to a bullock. This proved unused to carry burthens, as she three times threw off her load; at length disengaging herself from what she carried, she ran away, and I was

* The silver coin of *Srínagar* and *Latakh*; which should weigh, as the name imports, three *máshás*, the fourth part of a rupee: but the present currency has been much debased.

obliged to dismount and put her load on my bullock. The *Níti* people had proposed to carry flour for us to *Dábá* at a moderate price on goats, but we could not bring them to specific terms before we started, and were obliged to keep this matter open, notwithstanding this renders us still more liable to be imposed upon. To-day they insisted that three goats were equal to the hire of one man; and although this rate is higher than the absolute value of the goats, we were obliged to submit to the imposition. At *Níti* our *Barelí* rupees were current in payment for five *Timáshás*; at this place the carriers will only consider them equal to four; this circumstance explains one reason of the delay in settling the rate of hire.

June 30th.—Thermometer 46° at sun-rise. It has rained great part of the night, and the summits of the neighbouring mountains are sprinkled with snow. Yesterday the first part of our march was through a narrow gulley giving course to the *Daulí*, the bed of which was formed by the union of the base of mountains of great height. Those, which were principally composed of sand-stone, had their feet concealed by a large slope of sand and small pieces of stone, and their summits were ragged and rapidly breaking down. Of this description for the most part were those on the left bank of the river, and their craggy irregular tops were far removed from the channel. Those of the right bank were principally of granite of a green colour, where washed with the water, and blue, blackish and brown above. The face of these, though by far more perpendicular than the other, and in most instances almost entirely so, shewed manifest signs of the destroying power of the weather. Some of the blocks of stone, which lay in the channel of the river, were of a kind of pudding stone, the insulated pebbles being of a reddish or bluish colour, and the cementing material of green granite; were these masses in situations where they could be worked, they would furnish

most beautiful slabs, as their union is most intimate, and the friction of the water alone has given to many of them the smoothest surface imaginable. At the union of the *Dauli* with the *Hiwangal*, we took leave of trees; the last we saw being birch and small firs on the right bank of the *Dauli*, just after the other stream had fallen into it. The character of the mountains before and on each side of the slope, on which we were encamped last night, is of a different nature; though bold in their forms, their outline is rounder, less abrupt, and the line of their summits more continued and agreeable.

I awoke at a very early hour, and was immediately seized with difficulty of breathing and great oppression about the heart, which was removed for a few seconds by sighing deeply. When on the point of falling asleep, the sense of suffocation came on, and the sighing became very frequent and distressing: however, as the air became a little warmer, this affection somewhat subsided. Several of the people are suffering from headaches, colds, and affections of the intestines, apparently attributable to the great and sudden changes in the state of the air; as, in the middle of the day, the thermometer often stood 30° higher than in the morning.

March at six.—At 3021 paces, desert the *Dauli*, within two cós from its source at the foot of a mountain called the *Gangá-nóli*. At 5360 paces, commence ascending the *Ghati* or pass which separates *Hindustan* from *U'ndés*. Ascent very steep and difficult. We rode upon our bullocks the whole of the ascent, which was a mile and three quarters. At 7470 paces reach the summit, where we find a heap of stones, on which is a pole with pieces of rag attached to it; and as it is customary for every caravan or even for a single traveller to add his mite, we ordered a bit of cloth to be suspended in our name. This custom is supposed to entail the accomplishment of the objects of the journey to every one who

observes it. We passed over an extensive plain thickly covered with large stones, upon which the bullocks tread with extraordinary firmness. This plain is bounded on every side with mountains; those behind are covered with snow, without any mark of vegetation; those before are equally bare, but without snow. Distance this day about five miles and a half.

The first ascent was very steep, but not so difficult as the second, which is called the *Níti Ghátí* or pass. Here our conductor, AMER SINGH, had some fears that our progress might be impeded by some guards from *Dábá*, and whilst ascending, called to the Pandit, who had got the start of him, to examine whether there were any watchmen on the summit.—He appeared not a little gratified on learning that there were not any. The height of this pass is so great and long, that a very small body of resolute men on the top might defend it almost against a large army, merely by rolling down stones.

We found the sun hot about eleven, when we began to climb; but it was stated that about three it became so cold that it would be scarcely possible to support it; however, I conceive this to be an exaggeration. In some parts of the stony plain, the snow lay in masses, over which the bullocks trod without hesitation; and in others, it was melting. Part of this gently ran over the surface into ravines, and part soaked into the ground, and probably broke out in springs at distant places. Between the *Níti Ghátí* and the northern face of a hill adjoining a stream called the *Jandú*, there was not the smallest trace of vegetation.—The distance was about one half cós; but just on the brow of the hill declining to the river, were some bushes of furze and green mounds formed by a kind of moss, which is remarkably close and firm.—The stony plain was of great breadth, and was intersected by deep and broad ravines, which took off the melting snows.—These ravines all ran towards the North and East, and are the sources of various streams, which,

joining in their course, give rise to the *Setlij*. The last range of hills had been represented as not so high as many in *Garwal*. However, from the view which I have had of them, it appears to me that they are higher; and the general difficulty of breathing experienced by us in passing them comes in confirmation of this opinion.

We encamped on some flat ground on the bank of the *Jandú*, a river which receives the *Sheku*, and another branch from the northern face of the great *Himalaya* range. It was extremely hot when we arrived; and as there was no natural shelter, I laid myself on the ground under a thick blanket. Though oppressed with desire for sleep, I found it impossible to indulge the inclination, in consequence of oppression in breathing, the moment I was dropping asleep; and deep sighing only proved a temporary relief. At three o'clock the wind became very violent, but abated in the morning a little before sunrise. Two *U'niyas*, going to *Nítí* with salt, here met AMER SINGH, and started, as he said, many objections to our proceeding. He thought it prudent, that they should return with us, lest they might spread some report that might be prejudicial to us.

July 1st.—Thermometer at sun-rise 41°; march at 5, 35 A. M. At 3205 paces reach the summit where there is a heap of stones. Here we found the two *U'niyas*, one of whom was busied in lighting a fire, into which the other threw some incense, which he had previously bruised on a stone. He then leisurely walked round the pile of stones, in the midst of which was a statue having a piece of cloth tied to it; and, whilst walking, uttered a long prayer. To the East was the sacred mountain near the lake of *Mánsaróvar*, tipped with snow, and called *Cailás* or *Mahadeó ka Ling**. Turning his face towards this

* There are two mountains of this latter name: one near *Gangotrí*; the other at *Cailás*.

mountain, and after raising his hands with the palms joined above his head, then touching his forehead, he suddenly placed them on the ground, and going on his knees, pressed his forehead to the ground. This raising of the hands, and prostration of the body and head, was repeated seven times; the other *U'niya*, less devout perhaps, contented himself with three salutations and a short prayer.

Came to a large plain divided into several portions by broad ravines, and having several broad but not high hills on it. The only marks of vegetation upon it are low bushes of the furze, which may be called Tatarian, and small mounds of the compact moss before mentioned, with here and there a small tuft of a thin silky grass just springing up. Patches of snow still upon the ground, and splashes of water in which the feet sunk considerably. Although I give our *Nítí* friends credit for detaining us as long as possible, I nevertheless think we should have found some difficulty in passing these plains ten days ago, from their then swampy state. At 5400 paces, leave some snow in a hollow close to the left. At 5840 paces, come to another heap of stones, and descend rapidly along a ridge between a water-course, now dry, to the right, and one to the left, having a stream running down its bed. At 6000 paces descend. At 6965 paces, encamp on the left bank of the *Chastu* river, the source of which bears S. 70 W. and springs from the northern base of the great *Himalaya* ridge. The bed of the *Chagla* river is about the sixth of a mile broad, pebbly and fleet, with several small but rapid currents running down it. The rivers to the South of the great *Himalaya* ridge are narrow, from the sides of the hills being very steep and their bases forming a narrow angle with little valley. Those which rise on the northern base of the same ridge have broad flat channels, the water draining into them more slowly from the table-land and the more gradual and gentle slopes of the hills.

A hunter, whom we have long employed unsuccessfully, this evening brought in a female *Baral**. It was about the height of a hog deer, (Cervus porcinus) with its legs and feet much like the sheep, and some similarity in the head, but the ears were thinner and narrower. It had eight teeth and two horns which curved lightly backwards. Its hair was very hard, and on the neck close to the skin grew some fine wool. Its general colour was ash or grey, but it had its shins and tail darker than the rest, and under the belly it was nearly white. It had four stomachs and a gall-bladder ; a vesicular tænia was in the mesentery, but I broke it in endeavouring to extract it. Were it not fanciful to suppose a chain in the works of nature, I should say that this animal was the link between the deer and the sheep.

In crossing the plains I have seen no insects save a few small yellow butterflies ; no reptiles but a little active lizard of a dun tint ; no game, and no birds save the red *Túti*, larks and linnets : but at our encampment there were ravens of a large size with a loud caw, an immensely large eagle on the wing, and a blue pigeon with lighter plumage than that common in *Hindústan*. I conceive that no trip would be more instructive to the physiological Botanist than one across the mountains which separate *Hindústan* from *Tatary*, as plants of the same kind vary in their size, tints and strength, according to the difference of their situations. Sometime I thought that I was mistaken, but having seen the habitudes of many flowers differ extraordinarily in different places, and as the difference between those on the summits of gigantic mountains, and at the bottom of profound glens, was presented very frequently to my eye with intermediate shades in intermediate places, as to elevation within a short space, I was enabled to recognise their identity of family,

* Seems to be Ovis Ammon. C.

after a little time, without difficulty. At sun-set high wind arose. Thermometer 54°.

July 2d.—Thermometer 5, A. M. 44°; wind subsided during the night. The general direction of the rivers which we now meet with, is E. by N., although they rise from S. 70 W. As the cattle had strayed, we were delayed until half past eight. At 5168 paces the mountain, along which we have come this morning, ends parallel to the left one. At 6845 paces arrive at our encamping ground, which is bad, as there is only one small spring, from which the water is taken by a small ladle as fast as the hole fills, and this is very slowly. Here we found a square tent of black blankets pitched with four poles at the corner, and belonging to some *U'niyas* who had come from *Dábá* to graze their goats. As the water was not in sufficient quantity for the supply of the *U'niyas* and the *Níti* people, another well was dug, which gave what was required for cooking; but that for drinking was brought nearly three cós. An *U'niya* woman, wife to one of the goatherds, very good-naturedly filled the water-vessels of those persons who came to the little well, and did not take up her own part till the different candidates for water received the quantity which they asked for. She had rather a pleasing countenance, was of middle stature, and about thirty-five years old. There was much of curiosity in her looks at seeing us, but nothing of fear or impertinence. Her dress was woollen, and of the same form with that of the men. Her boots were likewise woollen, and much diversified by patches of various hues. Her hair, which was of a deep black, was plaited in tresses from the forehead down to below her waist, where the plaits to the number of fifty, after each being terminated by a cowrie shell, were assembled in a band of leather which was tipped with a tassel of red worsted thread: her head-lappet, if I may so name it, was of leather, and extended from the forehead down the back to the

waist, but in the latter part gradually ended in a point. At the forehead it was bordered with silver, and from this rim hung seven rows of coral beads, each row consisting of five, which were terminated by seven silver *Timáshás* that played upon the forehead. The crown of the lappet was studded with small pearls distributed in seven rows, and the lower part was decorated with green stones something like turquoises, but marbled, with coral beads, and many bands of silver, and of a yellow metal, probably gold, about a finger's breadth. A stiff band of leather something like a soldier's collar was placed loosely round her neck, and ornamented with five rows of coral beads. The collar was secured with a button and clasp of silver. In her left ear was a coral bead set in silver, and in her right were two smaller beads in the same material. On her right thumb she wore a square gold ring with characters engraved on the table.

On quitting the spring in the way to our encampment, we saw some of the *Bampo Marchas* sitting by their loads, with a dead sheep lying on the ground in its fleece, but having the entrails taken out; on a dish lay some of the intestines cut in lengths like black puddings, and I was led by this to inquire what they were and how made; and from the intimation which I received, was a little surprised to find the borderers of *Bootan*, well acquainted with the art of making black puddings. The carcass of the sheep was afterwards, I understood, roasted whole, by being frequently turned in a fire of furze roots.

This day we were treated with some chops from our *Baral*, and we found the flesh juicy, tender and high flavoured. There was a *Bootan* priest sitting with some shepherds from the neighbourhood, cheapening small wooden bowls turned out of knots of horse chesnut. They are very durable, the knotty structure preventing them from either breaking or warping. In the evening there were some peals of distant thunder, and an appearance of much rain; however we escaped with a few

drops, the mass being attracted by the hills to the north. The *U'niyas* had dogs with their flocks, which were fierce and much disposed to attack strangers.

July 3d.—Thermometer at 5,—58°. Marched at 5,—10, as our conductors were anxious to reach *Dábá* at an early hour. Road leading over a dry gravelly plain, much cracked, and with little vegetation, except here and there some low bushes of furze, small tufts of a silky grass springing out of this cleft, and a woolly plant like that commonly called "everlasting," perhaps a kind of dittany. A snowy peak in front. The road lies over a plain of great length, but not of above seven cós in breadth, and consisting of many levels or steps broken by deep ravines, the edges of some of which are as level as if executed by art. On the south, the plain is bounded by the last *Himálaya* ridge, just tipped with snow in stripes like foot-paths, extending along the windings of the ridges: on the north, by the *Cailás* mountains, the summits of which are marked more distinctly with snow, and the bases of which descend to the level of the plain by easy slopes and diminishing swells, forming a succession of steps separated from each other in the length of the plain by breast-works of broken ground. Behind, the mountains seem to meet in an angle near *Mahádéva ka Ling;* but the plain seems to expand before us till it is shut in by stupendous mountains, whose sides, as well as craggy summits, are apparently very thickly covered with snow. To the left, or rather to the S. W., are the mountains of *Baschar*. At the distance of about two miles, a little to the W. of N. is a most extraordinary face of broken ground. This represents pyramids, in some places joining their tops but separate at their bases; in others, separate at their tops but clustered at their foundations: buttresses of various proportions and forms; and no unapt resemblances to ruined castles and fortifications in piles above each other.

The town of *Dábá* is perched upon the top of a rock,

which juts out towards the river with an irregular declivity, and is surmounted by the highest eminence in the whole line which defends it from the N. W. At 5306 paces the river close below, and a few cultivated fields, which are the first we have seen in this country: encamp near a rivulet in the town.

It was considered proper that AMER SINGH should announce our arrival to the *Déba*, and inquire when we might wait upon him. It seems that there are three personages of importance here, the *Lama*, the *Wazír* and the *Déba*, who is properly the head zemindar. The *Wazír* was absent on business towards *Mánsaróvar*, and his son officiated for him.—AMER SINGH reported, that the *Déba* and *Wazír's* son were very angry with him for having afforded us carriage, as without this assistance we could not have come on; and he had more reason to be displeased, as he had sent two messengers to forbid our entering *U'ndés*.—AMER SINGH made excuses; saying they had delayed from time to time furnishing bullocks under the expectation of our being wearied and giving up the idea of proceeding; but that, so far from this producing the effect which he expected, we threatened to make him advance not only the expense of our stay at *Nítí*, which was considerable from the number of people we had with us, but also to pay the charges of the whole of a journey, which, by his not forwarding us, was likely to end in disappointment. But the *Déba* still remained displeased.

In the evening there was a consultation betwixt the *Wazír's* son, the *Déba* and the *Lama*, at which were present AMER SINGH, the old pundit, a sircar and a *Jouar* man. It was stated by the *Déba's* people that it was necessary to report the matter to the military chief, who resided at the court of *Gortope*, a place about two days' journey distant, and who exercised a general governing power over the country.

July 4th.—Thermometer 54°—AMER SINGH sent word, that the council was ready to receive our visit; and we set out towards the government house, which was about a hundred yards distant, accompanied by a few servants. The house on the outside was not of a very imposing aspect, though built of stone. Over the door a large dog was tied, which eyed us with attention, but did not attempt to molest us. We passed through several passages and small anti-chambers full of people, into a low room of about 18 feet square, in the middle of which was a small carpet for us to sit on. Immediately in front of us on a ledge raised about a foot, sat two young men, one of whom was represented as the *Wazír's* son, and the other as the *Déba,* each upon their cushions; on their right, and forming the upper end of another line of persons extending from one side of the room to the other, the *Lama* was seated upon a leathern cushion, next to him a priest, and then an interpreter; the *Seyánas* of *Nítí* formed an opposite line; and we were seated in the centre of a square of people, who, if not very clean, were at least orderly and respectful in their behaviour. The young men were large in their persons, the *Wazír's* son particularly so, and about twenty-five years of age; the *Déba* was somewhat older; in the features of both, the *Tatar* character was observable, though not in any very great degree. The *Lama* was about sixty, with a shaven head, dark complexion, serious and wrinkled countenance, and features of a common cast. The priest beside him was still darker, more ugly, and more greasy in his clothes, reclining partly on the floor, and partly on the ledge on the upper part of the room; near to the *Déba* was a young woman of pleasing face, wife to the *Déba,* and daughter to the *Wazír*, with a pretty child in her arms, and the left returning line from the *Déba* was begun by a writer of dark countenance. The *Wazír's* son was dressed in a large loose coat or gown of woollen stuff, striped blue, yellow, green, and red, alternately about a finger's breadth, and said to be manufactured at

Guinnak, the capital of *Chinese Tatary*. His hair was collected into one large plait which hung down his back, and he had no beard. The *Déba* had on a dark green woollen gown, and his hair was plaited in the like manner. His beard was plucked out, but he had reserved a thin mustachio on the upper lip; both the *Wazír's* son and the *Déba*, wore broad rings on the right thumb. Their ostensible use was for defending the thumb in drawing the string of the bow; but it served very conveniently also for trimming their tobacco-pipes, which lay in readiness beside them.—These were about eighteen inches long, in the form of the *English* pipe, but made of iron, decorated with embossed work and a rim of gold, and a circle of the same metal at the union of the bowl with the stem. A small japanned table was before each, and on them were implements for writing with two round wooden boxes japanned, and a large red and white china tea-cup.—The *Lama* had before him also a japanned long and low stand, upon which was a round box.—When we entered the room, the *Déba* was correcting a letter, which he had written to the commander of *Gortope*, and which he read over, desiring AMER SINGH to explain the substance of it to us.—He read with a distinct articulation, with occasional pauses. The language was soft; and the substance, as far as we could collect it, was as follows.—That AMER SINGH, and other *Seyánas*, had brought along with them two *Mahants*, and twenty-five followers, who were desirous of proceeding on a pilgrimage to *Mánsaróvar*; that the first representation of their being *Gorkhalís* or *Firingís*, was a mistake: and that the arms which they had with them, were only sufficient for their protection during so long and hazardous a journey as that which they had undertaken.—That the *Seyánas* had entered into an engagement that these were real *Gosains*, who brought merchandise to defray their way expenses, and that they would be responsible both in their persons and property, that they should demean themselves peaceably and properly whilst they should remain in the country, paying

for every thing they might require, and taking nothing by force; and as they had been put to much unnecessary expense by their being delayed at *Nítí*, the *Déba* trusted that the chief would give orders for their being allowed to proceed without delay. The *Déba* caused also a written agreement to be drawn out on the part of AMER SINGH, binding himself to the truth of the above deposition in the name of the several *Seyánas*, and to which he affixed his seal. The letter was forwarded to the chief of *Gortope*, after the consent of the *Lama* had been received.

It was stated that the *Lama* had never before left his college on matters of business; and we were to consider this as a great compliment paid to us. Between the *Lama* and the *Wazír's* son was an empty place which was supposed ordinarily to be filled by the *Wazír*; and before this was laid down our present at our first coming into the chamber: inquiries were made whether we would drink tea or eat parched meal, which we declined on the score of having just risen from our repast, but which we could not accept in our character of *Hindus*, these people having no caste; a large brass dish, half filled with butter and wheat-flour, was placed before us as some return for our present, and we took our leave.

Yesterday a person came to us from the *Déba* to inquire after our health. He looked about my small tent with much curiosity, and observed that my friend's half-boots were like those of a *Feringí*.—I had taken the precaution of having my *English* shoes furnished with long turn-up toes and tags at the heels, and this not being done to the others, excited his suspicion.—The redness of my face, which, from being exposed to a hot sun and cold wind was almost wholly deprived of skin, particularly attracted his attention. The explanation given was, that, before this pilgrimage I had been but little exposed to the sun which had produced the effect which he saw. The same inquiry was made by a very black priest who

came on the part of the *Lama*, and who said that if such was the influence of climate, he supposed he should become white, if he were to go to the country I came from; in about two hours after our visit was paid, the *Wazír's* son, the *Déba*, the interpreter, the *Déba's* wife and sister came to look at our finery, and admired several things, but found all our articles vastly too dear; and I think in general they were right; for we had affixed prices in some measure to make up for the expenses to which we had been subjected by imposition and delay.—The *Deba's* wife fell in love with a ring which she actually asked for, and of course obtained. Five "children of a larger growth," who were extremely inquisitive, were desirous of knowing the contents of a bundle of my clothes; they were made in the *Hindu* fashion. The *Déba* was anxious to see our guns; but, from his mode of handling them, it was clear that he knew little of the use of fire-arms. We offered our guests tea, which they refused, but they partook of some sweet biscuits, gingerbread, and sugar-candy. After a stay of an hour, they left us, apparently satisfied with the reception which they had experienced.

July 5th.—Thermometer at sun-rise 48°.—The town of *Dábá* is situated partly upon irregular eminences, forming the side of a flat ravine descending rapidly to the river *Tiltil*, and in the bed of the ravine itself. Its situation, construction, and appearance, are altogether unlike any thing which I have ever seen before. The ravine, or bay, is surrounded by heights consisting of strata of indurated clay and thick beds of gravel. Some of these heights are above three hundred feet in elevation, others are less. They are broken into masses of various shape by the torrents of snow-water which fall down their sides. Some are like large buttresses with pointed tops; and others, though of greater height, are surmounted by flat spaces.—Their sides are full of excavations, to some of which are wooden doors; and others are merely caverns; of these, some serve as houses, but the greater

part as granaries or rooms in which the inhabitants deposit their property, when they leave their houses in the town for a warmer situation during the most severe season of the year, when the ravine is nearly choked up with snow, so that *Dábá* is only to be considered as a summer residence. The houses are of stone, two stories high, white-washed on the outside below, surrounded with a band of red and *French* grey above, and having terraced roofs surrounded with parapet. The tops of the walls are decorated with lines of pieces of different coloured rags tied to strings. The inside is very filthy; the floors of little yards, which lead to them, being covered with bones of sheep and goats, fragments of bones, and locks of wool. From the ground-floor, which is raised, a wooden ladder leads to the terrace, which in the *Wazír's* house is divided into an enclosed verandah that serves as a chamber of audience, and into an open space used as a promenade by all the family. The town is divided into three parts, viz. a college, the residence of the *Lama* and his *Gelums*, or monks; a nunnery; and the houses of the *Wazír*, *Déba*, and the laity in general. Immediately in the centre of a semi-circular sweep formed by the houses, are temples or mausolea of *Lamas*, with smaller ones attached to them. These are circular at their base, diminish by smaller circles, and terminate in a point covered by plates of copper, like umbrellas, and gilt: in the centre above these, surrounded by horns, and painted of a red colour, stands an irregular building with one door, and surmounted by a square smaller building, tiled with brass gilt, and decorated with grotesque figures: it is the temple of *Náráyan* or the great spirit. The parapet of this building was adorned with masses of black hair, formed, I believe, of the tails of the *Chourí* cow reversed, plaited and intermixed with pieces of some shining substance, and having on their tops iron tridents.

This morning was dedicated to a visit to the temple, and afterwards to the *Lama*. A priest, by order of the

Lama, opened a locked door, on which was a ring attached to the centre of an iron embossed shield-like plate inlaid with different metals. This led to the porch of the temple, lighted by an opening in the roof to the East. The side walls were painted *al fresco* on a white ground, with a bold sketch of some deity, with large staring eyes, and enveloped in a kind of glory. The doors being thrown open, we entered an apartment of about 30 feet square, lighted only from the door, and from two large silver lamps on attached pedestals of the same metal, about 18 inches high, placed upon a low japanned stool in the middle of the floor. At the upper end of the temple, and immediately fronting the door, was a figure of *Náráyan*, of copper gilt, in the *European* sitting position, and about 20 feet high. The hands were lifted up, with the palms gently inclined forwards, as if in the act of benediction.—These, with the feet, were the only parts exposed; the rest of the figure was draped with narrow robes of silk. On his right hand was a smaller figure of LACSHMÍ; and on his left, that of a *Lama* crowned with a conical cap and dressed in pontifical robes.—These figures, also well executed, were likewise of gilt copper; a flight of small benches descended from the feet of each of the last figures, on each side of the room, as low as the foot of the throne, leaving a space clear before. On these was arranged in rows the greatest assemblage of *Hindu* deities I have yet seen. They were of brass, exhibited great variety of countenance, and much better proportion of parts than I have before witnessed. The whole of the group just mentioned were placed in a recess bounded by pillars reaching from the roof to the floor, and separated from the body of the temple by a wooden screen about four feet high, furnished with shelves descending in gradation to the floor.—On the upper range were the effigies of deceased *Lamas* carved in wood, with their mothers, and the principal persons of their household; a large gilt pyramid was on one side of this screen half concealed by a silk veil, and

another elevated figure, something like a sceptre on the other; each on a large gilt stand. Lower down was a gilt chest; and on the floor, in the space fronting the door, was a low table, on which were ranged several rows of brass, silver, and gilt or golden bowls, containing water for the use of the deity; a small quantity was poured into my hands, part of which I drank, the rest washed with and threw over my head, as I was directed by the officiating priest: we had a carpet spread on the floor in front of the deity, and immediately under a large expanded umbrella. I had given a present on my first entrance, and afterwards added another trifle for the particular use of the priest in attendance, who desired us to come forward, and examine more minutely the figure of the deity, and receive a portion of his sacred vestments consisting of a stripe of a white silk gauze which was put round our necks. In returning we saw masks of leather in imitation of the heads of stags, tigers, bears, and demons, worn at the celebration of some great festival, ranged on shelves; and on wooden frames, piles of sheets of writing within small planks of wood, like the boards of books without backs, lying on open lattice-work tables.

On leaving the temple we were desired to turn some wooden cylinders supported on iron cylinders, in recesses in a wall, and to go round the building seven times, a ceremony which it seems is prescribed to those who wish to have an audience with the *Lama* after a visit to the temple. Whether this was mentioned merely to enhance the sanctity of the place or the personage, or was really the custom, I know not, but the ceremony was interrupted after one round, and setting the whirligigs, by a message from a priest, that AMER SINGH was wanted elsewhere. He understood the signal, and went to a small door, which when knocked at, was opened by a laughing ugly fellow, who pointed to four coils of shawl wool, for which a bargain was immediately struck.

We were desired to make another turn round the temple, and were afterwards led up two very steep flights of stairs towards the *Lama's* apartments. Over the first door hung a string to which were attached some leaden pipes, in imitation of the iron ones used for smoking. In an open apartment, up a third flight of stairs, surrounded by a veranda, on a small and thin cushion placed upon an old mat, the bishop of the diocese was seated. We each made a present of a rupee, and three for the *Gelums;* the latter he would not touch, but sent for the steward to take charge of, and ordered that they should say prayers for us three times; after which the money should be divided amongst them. His manners were mild and conciliating. To our interpreter he signified that he did not approve of our design of building a hospice at *Mánsaróvar*. We stated that we should attend to his opinions, even if our money had been in greater plenty than it now was.

At the suggestion of Mr. H., I laid the string of beads, which I usually wore round my neck, at his feet. He was struck with the circumstance, rose, beckoned to two *Gelums* to accompany him, and after a short absence, returned with a pot of sour milk, some butter in a bladder, a kind of cheese and a cake of sweetmeats, which it was signified was considered so good as to be thought worthy of being presented to the deity. He also brought a string of wooden beads, which he desired me to accept, as a mark of friendship, in return for mine, and which I accordingly put on; we departed highly pleased with the manners of the prelate. In the evening we paid a friendly visit to *Wazír's* son.

July 6th.—Thermometer at sun-rise 46°; I had caused the pundit and AMER SINGH to inquire for wool, in order to purchase a quantity and forward it to *Nítí*, and have this day the mortification to find that the people dare not sell any until we shall have received per-

mission to buy from *Ghertope*. This is caused by strict injunctions to all the owners of flocks not to sell any shawl wool except to the *Cashmírians*, or their agents, in consequence of a representation having been made to the Government, that the *Jouaree* merchants had bought some last year, and that the *Cashmírians* would suffer, if any of this kind of wool were to pass into other hands.

During the period that the *U'ndés* was governed by *Rajas* of the *Rájeput* cast of *Súrajbans*, and subsequently that it passed under the dominion of the *Chinese*, the independent *Tatars* of *Ladák* were extremely troublesome to the inhabitants by their frequent inroads, and only ceased their depredations in consequence of this country being given in *Jagír* to the *Dela Lama*. The sacredness of this personage, who is the head of the religion of the *Tatars*, caused them to desist from their incursions, and probably, would have the same influence in the event of any alteration in the current of trade: but to this, it is likely, that they would make great resistance.

July 7th.—Thermometer 42°; The *Wazír* made us a visit and staid nearly an hour. I observe, that the priesthood and the immediate officers of Government are in easy circumstances, as also are the goatherds, but the rest of the population are plunged in the most abject poverty, and literally clothed in rags.

July 8th.—Thermometer 46°.; at noon in a tent 73°. We have heard that an answer is arrived from *Ghertope*. In the evening I went to inquire the determination of the Government upon our affairs, and was informed that in the following morning the letter should be read to us.

July 9th. Rained.—Thermometer at sun-rise 50°. It being past eleven, and not hearing any intimation of our presence being desired, I proceeded to the govern-

ment house, and found the Council sitting, assisted by a number of people whom I had not seen before. I addressed myself to the Council; and as we had been informed that a letter had arrived from *Ghertope*, I begged to learn the sentiments of the Governor in respect to us, and their final determination upon them. The *Wazír* said, in reply, that the Governor of *Ghertope* had signified to him, that intelligence had been conveyed to him about three years ago, that some *Europeans* were about to come into the country; and, whether we were the persons alluded to or not, he wished to see us, and the goods we had brought, of which he requested an exact inventory to be forwarded to him, and prohibited any sale till he should have inspected them. I told them, that, although we had suffered much from delays, yet that out of respect for the authority of Government, we were ready to go to *Ghertope*, or even to *Lassa*, should it be required of us, as we had no other than honest intentions; but as we were ordered to go by the Government, it was but reasonable that we should be furnished with carriage. After much altercation, it was agreed, that cattle were to be ready in three days; and that as many as could be procured should be purchased, we taking the responsibility of the measure upon ourselves. In an hour, the interpreter came to say that we should have the requisite bullocks, and we are to start in three days from this date.

In the evening we went to see the temple of NA'RA'YAN again, and to pay our parting visit to the *Lama*. We found the old man in a small cell just large enough to allow of three people sitting down; with a raised bench of brick, fronted by a railing of wood, with a little door in the centre.—Although early, he was retiring to rest or meditation; and considering the wealth of the college, which is reported to be very great, was a real and edifying picture of humility. He wished to know very particularly if we should return by *Dábá*. We answered certainly. He was much pleased with our attention, and

putting out his hand to take hold of my friend's white gown, he being a little nearer than me, said " I pray you let me live in your recollection as white as this cloth." There was something particularly affecting in his manner and utterance, and I could not help bending over his outstretched hand with emotion, as I took leave of him.

I mentioned that there are a college and a nunnery. The *Gelums*, or monks, seem a happy, good-humoured set of people, dirty, greasy, and in good case. They carry on a considerable trade in sheeps' wool and salt, in exchange for wheat and barley. Of the nature of the institution, I could learn little. Of the *Paraphernalia* of the temple, the resemblance with those of the *Romish* church was very striking. The *Gelums* observe celibacy. There is a nunnery, the rules of which are said to be severe. Commerce with man is punished by solitary imprisonment, and a heavy fine.

July 10th.—Thermometer 48°. This evening we purposed to mount a hill, on which formerly was a house belonging to the *Raja ;* and there still remains a temple. In our way, passing close to the house of the *Wazír*, we found him, the *Déba*, and several servants, shooting at a mark with bows and arrows. There was novelty in the contrivance of the target. The bull's eye was composed of two parts, the inner one, about four inches in diameter, was of wood, convex, and painted black in the middle, with a circle of red on the outside. This was placed in a roll or cushion of cloth which it fitted tightly. The arrows were tipped with wooden balls, some of which were solid, and others hollow, with four holes in the end, which caused a whistling sound as the arrow flew through the air. When the arrow missed the target, and struck against the butt, it fell to the ground ; if it hit the soft shell of the target, it did not disengage the bull's eye ; and no arrow was accounted a shot, but that which dislodged the eye from the target. When struck out, the

eye did not fall, but dropped a few inches lower than the circle, where it was held by a string from an upper projecting rod. This is altogether not a bad contrivance, as it prevents disputes. These people pull the bow more in the *English* manner than in that of the *Chinese*, their neighbours and masters; but their instruments are very indifferent; and they are not formidable archers. They use also the sling, but I had not an opportunity of seeing them exercise with it. Leaving the archers, we ascended to the top of a hill about 300 feet above the level of the lower town, along a zigzag road, and through some winding passages excavated with little art in the strata of gravel and indurated clay. The inside of this temple was by no means so rich as that on the other side, and the priest complained of poverty. He said, he felt an interest in our welfare, and recommended our departing without delay, as the governing people were not good, and we might, if we stayed long, be caught by severe weather, and perish. We thanked the old man for his good advice, and left him more substantial proof of our regard, for which he was very grateful, and placed round our necks small stripes of gauze. During our stay, the *Gelums* began an evening Hymn, which was not unmusical; but, in a very small cell sacred to BHAVA'NÍ, three persons were making a noise not unlike the quick chirping of grasshoppers. There were small statues of the last *Súrejbans Rájá*, his son, daughter, priest, treasurer, and other persons of his court. As it is the custom here for a considerable portion of the property of every person who dies in affluent circumstances, to go to the church, and as likenesses are sent to the priests, who pray for the repose of their souls, as in the *Roman Catholic* faith, I apprehend the series of figures represented the whole of the court; and in this idea my belief was strengthened by observing some females of different age and character on a bench, immediately behind that on which the *Rájá* was seated. The head-dress of two of these was very similar to that of abbesses. The *Rájá*,

whose resemblance was here preserved, in consequence of the frequent inroads of the *Ladákis*, and of his father being killed by the *Tatars*, was sent by the principal people to request the protection of the *Chinese*, who accorded it and assisted him against the invaders. But in an earthquake his house was precipitated, along with himself and his household, into the plain, and the *Chinese* afterwards availed themselves of his death, to take this country for their own use, and after a certain period to give it to the *Dela Lama.*

At this last temple there were few musical instruments; but at the great one, we saw some prodigiously large brass and copper trumpets, made of tubes, which shut in and drew out like telescopes, and had small mouth-pieces or pipes, which were distinct. There were also drums of great size set in frames and beat upon their sides.

There are granaries in the rock on which the small temple is situated, in which they say that there are many thousand maunds of rice, for the use of the people generally, in the event of any great exigency; and this is certainly a very prudent precaution, as scarcely any grain is raised in this country, and the inhabitants are dependent for their annual supply of rice and barley on the *Marchas* of *Níti* and *Jouár*. Shortly after the period that the *Gorkhas* made an irruption into the territories of the great *Lama*, the *Chinese* government ordered 30,000 maunds of rice to be taken out of the magazine, which is in fact the property of the public; but how the funds are provided, I did not learn.

July 12th.—Thermometer 51°. The *Chouar* bullocks arrived at day-break; and having paid for their hire, as well as for the food of two horsemen who were to accompany us, into the hands of the interpreter, we struck our tents and took leave of *Dábá*. At 4906 paces arrive at the summit of hills, said to contain gold. To

the right are clay hills, broken down by melting-snow into strange-looking projections and hollows. Scarcely the slightest appearance of vegetation, and yet a hare was seen upon these heights. At 5116 paces reach a narrow pass, through which we go and descend to a stony plain, then enter a very deep water-course, now dry, of which the banks are perpendicular, of vast height, and formed of beds of gravel. I examined their structure with great attention, in hopes of finding some traces of marine productions, but was disappointed. At 7230 paces came to a plain sloping to the *Satúdrá* or *Setlej*. It came from the S.W. by W. and ran N.E., receiving here the *Tiltil;* breadth 80 yards, depth 3½ feet. The current was so rapid, that I could scarcely keep my footing. On the plain were two very beautiful poplar trees, in which were many goldfinches, which regaled me with a song, whilst I sat under the shade of the trees, waiting for the party, having reached the river half an hour before they arrived.

The broken ground in the neighbourhood of *Dábá*, and which we did not lose sight of, until we quitted the bed of the *Tiltil*, was very extraordinary in appearance. The right bank was of great height, and the melting snow had cut the clay of which it was formed, into channels, leaving intermediate ridges, which, from difference of hardness, or being acted upon by the water in different directions, was fashioned into great diversity of figure, in some places representing castles, fortifications, houses, and masses which baffled description.

We have passed three villages to-day, all painted, and of different colours. These are winter residences of the inhabitants of *Dábá* and *Dong*.

Just at the point when we began ascending, the valley narrows suddenly to a channel only just sufficient to give passage to the water. The hills, which are stated to be

rich in gold, are granite of mixed colours, the red predominating, with horizontal strata of quartz and small fibrous veins of a white material like agate, descending perpendicularly: where the rock has been exposed to the weather, its surface is broken into small pieces, having little more cohesion than clay burnt in the sun. This decomposition is effected, I suppose, in consequence of the different materials of which the mass is composed, not being intimately united, and water entering the fissures where it congeals, &c., bursts the structure.

The gold here is separated by washing, there being no fuel, in the neighbourhood; or rather no wood; for, from the appearance of some of the hills, I apprehend that they hold coal. In the bed of the *Setlej*, were many large flowering shrubs, which I take to be a species of the tamarisk. I have found it from three inches high to eight feet, in situations more or less favourable. The yaks and goats were very fond of the foliage. I observed, that the bite of the yak is quicker and nearer the ground than any other species of neat cattle I am acquainted with; a peculiarity which fits them for the short and scanty herbage of an *Alpine* country.

We have descended much to the *Setlej*, notwithstanding the mountains are high, which intervene between this river and *Dábá*, and the heat is great. In the tents the thermometer stood at 96°. Distance come this day 7525 paces.

July 13th.—Thermometer at sunrise 56°; march at 6° 30′. This plain is stony, about half a mile in breadth and length, bounded partly by heights and partly by the *Setlej*. It is full of shallow pits made by persons who have dug for gold-dust, and left heaps of stones by the sides of the excavations. At 306 paces ascend to another flat which has likewise been dug. At 1835 paces reach a small flat, where there has been cultivation; caves of gold

mines in the rock to the left, now deserted. At 5975 paces reach a house, near which are two gold mines with tunnels under the surface.—Heretofore the excavations were perpendicular. The earth is dug out and carried to the brook to be washed.—At 6182 paces arrive at the ground for encampment near the village of *Damoo*, situate half-way up a rock on the right bank of a water-course, in the direction of which we travelled most part of this day, consisting of a few red houses, and many caves, with two or three temples.

In the evening killed seven hares.—There are great numbers of these animals. They are shorter in their bodies; longer in the hind legs, and somewhat smaller than those in *England*.—Their fur is much finer and longer: altogether they are much paler generally. The under part of the neck is fawn colour, sides greyish, belly white, and the thighs are furnished with thicker and longer furs than the rest of the body, and of an ash or lead colour mixed with grey.—When disturbed, they fly to the mountains, but frequently stop and rise on their hind legs to look at their pursuers. Their flesh is well tasted; and they are very prolific; as in two there were eight young ones. Some cultivated land under the grain called *ad'hí jou*, well irrigated.

July 14th.—Thermometer 52°; leave our ground at $5^h\ 25'$. At 5780 paces much saline efflorescence on the ground, supposed to be soda, cracked under the foot like slightly frozen earth. The skeletons of two wild horses were lying in the valley. In various parts of the road we have found many skulls of the male *Baral*, with enormous horns.—Some have at least been from 50 to 60 lbs. weight. We meet again with rhubarb which we had long lost sight of. At noon, thermometer in the tent 75°: on a high hill to the right, three wild horses suddenly made their appearance, probably for the purpose of coming to water; after looking at us for some time, they

went off at a smart trot. They were too far off to afford a very clear view, but seemed to be about thirteen hands high, a bay colour ran along the upper part of the neck, and back and sides were of a fawn or azure colour. Their heads appeared thick and short, but well carried: their bodies round, short: general shape compact, clean, and tail thinly furnished with hair.

July 15th.—At sun-rise, thermometer 41°; march at 5^h 40′. At 574 paces a bed ofsnow in the water-course. The plashes of water on the surface of the ground, melted during the day, are frozen during the night. Road ascends to 1934 paces, when we reach the level of a beautiful plain about a mile and a half broad, with mountains to right and left, and narrowing to a gorge about three miles in front. Mountains on the left have snow falling upon them. At 4800 paces reach the right side of the valley, which declines to the North: a stream arises from a bed of melting snow, direction N. 65 E. At 5240 paces a second bed of snow. Middle of valley stony with two currents of water. Animals of a fawn colour, about twice the size of a rat, without a tail, and having much longer ears than rats; *Q. Marmot** ? They burrow in the ground, and seem to associate with a smaller species of the same form and general character, but of a much darker colour; perhaps younger ones only. One of this sort was shot yesterday, being taken for a young hare, which it resembles in its mode of jumping and sitting on its hind legs. At 5551 paces the valley narrows to 600 yards; surrounding hills said to contain gold, which is sometimes found in lumps of considerable size. At 9786 paces encamp; at 11 A. M., cloudy, high wind; begins to rain; afterwards hails, and this alternately with strong wind till sun-set, when the atmosphere clears and the wind falls.

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* Probably a new kind; as all the known species of Arctomys have short ears or none. In other respects seems to agree with the genus

July 16th.—Thermometer at sun-rise 34°; our tents frozen. March at 6^h 45′ along the left bank of the stream which we followed yesterday; saw close to our ground a large pair of horns attached to a skull, which I supposed to have belonged to the *Baral* or wild sheep, but was said by the *U'niyas* to be an animal called *Douga*. At 1905 paces large fragments of frozen snow fallen into the water from the rocks, almost choaking up the channel, which is not above seven yards broad. The frozen snow, or rather ice, when broken from the edge of the projecting banks under which the water flows, divides into pyramidal or conical nails, the small part downwards. Red stones, something like cinnabar of antimony, with black shining crystals, interspersed through their substance. Large lumps of green granite glazed over, in parts with a kind of green glass, in the bed of the stream. At 2000 paces enter into a narrow defile of frozen snow, which the stream has cut through and deserted. A ledge of about eight feet thick, is suspended to the rock at each side, leaving a narrow passage between them, 94 paces long; at 2435 paces came to another defile of ice. At 3420 paces, rhubarb plants in plenty. At 6375 paces our stream joins another; and the road leads to a plain, on which were two wild horses, and a prodigious number of hares. At 8025 paces reach the bed of a clear, broad, and rapid, but not deep river; plain dug in many parts for gold. Having crossed the river, and reached our ground at 1 P. M. and 11,962 paces, we encamped.—We killed this day one hare, and two grouse, or birds of this class, of a fawn colour, feathered legs, broad feet, covered with a pad of horn, divided into many points, like shagreen, and having two long thin tail feathers. This river, which rises near *Gongré*, goes past *Ghertope*, then close to *Laták* or *Ladák*, and is said likewise to proceed to *Bokhara*, where probably it falls into the *Ammoo, Djihon* or *Oxus*. The mountains on each side of this valley or plain, which is about five miles across, dip much to the N. W.

July 17th.—Thermometer 39°. Ice or water near our encampment. Saw some *Brahminí* geese* and small shrikes hovering over the river. At 336 paces ascend the foot of the mount, ranging with the river, which runs about eighty yards to the left. At 1360 paces, the plain is divided into an upper step about two miles broad, and a lower one, in which is the river following the middle of the lower step or valley, and about a mile in breadth. Many wild horses on the upper step. At 3200 paces myriads of small flies, very troublesome. At 4205, road very uneven from hillocks and hollows. The surface of the ground covered with salt. At 5720, the various currents which divided the valley unite and form a large and clear stream, of considerable rapidity. At 6000, a very large but dry water-course leads to the river. At 8600, a valley opens from two to three miles broad, and covered with large pebbles. Heat very great. At 11278, come to five currents of a river, which we cross. This river rises from mountains covered with snow lying S. 75 E., and falls into that just mentioned. *Ghertope*, formed by some black tents, at a considerable distance, bears from hence N. 5 E. The intervening plain, and indeed as far as the eye can reach until it is bounded by a pass to the N. W., is covered by prodigious bodies of sheep, goats, and yaks, amongst which is a small number of horses. The number of cattle cannot I think be less than 40,000. At 14,000 paces reach the town, or rather assemblage of tents in clusters, made of blankets surrounded by hair ropes fixed to stakes. Over the tents are variously coloured shreds of silk and cloth as flags.

We had only just pitched our tents, and arranged our baggage, when a messenger arrived from the *Déba* and *Wazír*, desiring us to pay them a visit to-day, and we should proceed to business the following day; the terms

* Anas Casarca.

of the message were too pressing to admit of delay, accordingly we proceeded to the house of the *Déba* with our presents. It was enclosed by a fence about four feet high, and surrounded by the same litter of bones, horns, and scraps of wool, that we had remarked at *Dábá*. After entering an enclosure, we stopped a few seconds at the close of a small yard, in the front of which were some matchlocks and bows and arrows, piled in a kind of guard-house; and we were desired to go through a low door into a room, about twenty feet long. At the opposite end, on a raised bench of earth, covered with a carpet and cushions, sat an elderly man, bare-headed, and clothed in a greasy yellow damask gown. This was the *Déba*. On the right hand from the *Déba* was a dark complexioned person, who was his younger brother; and on his right again, a rather fair young man, who was the son of the late *Wazír*, and now shared the authority of government with the *Déba*. The *Déba* had rather a shrewd countenance. His brother had a sullen expression, and was ill-favoured. The young *Wazír* had a pleasing face, of the *Tatar* kind. We had cushions placed on the side of the room, opposite to the young men; and our attendants with those of the household occupied the lower parts of the chamber. Some conversation passed through the medium of our interpreter, which turned upon our usual place of dwelling, and the articles we had brought with us, of which an inventory was handed to the *Déba*, and after being looked over by him, given to the *Wazír*. The apartment was built of sods. The roof was flat, made of branches of trees laid across, covered with sods, and having a square hole near the centre, which answered the double purpose of letting in light and giving vent to smoke: the sides of the room were hung with dirty yellow silk. On the right hand of the *Wazír* were two dogs. The *Déba* sat at the upper end of the room on a platform of sods two feet high, covered with an old carpet, on a cushion faced with *China* satin. Before him was a little long table, on

which a box, with barley-meal, a blue and white large *China* tea-cup, a thing like a small lead tea-canister, used as a spitting pot, and a greenish jasper tea-cup, less than the other. This latter was frequently filled by a boy, from a large earthen tea-pot, with a pale-coloured lid; apparently cold. Superstition in eastern countries attaches to jasper cups the property of splitting, if poison be put into them; and this trait, at first blush, does not speak in favour of the morality of our *Tatar* friends.

Over his head, to defend him from the earth of the sods, or other annoyance, were two or three pieces of common chintz, and at the right corner was a small square apartment, made by a chintz curtain, in which was a light; as the *Déba* lighted his pipe from a chafing-dish of charcoal, which was on the floor, I suspect him to be a worshipper of the sun and fire; and this suspicion is strengthened by the long hymns, which our attendants chanted on the road, at the first appearance of that luminary.

Our interview was very long; but it was easy to see that the impression of our being either *Gorkhas* or *Felings*, (so the *Tatars* call *Europeans*) wore off either by the representations of the *Déba* of *Dábá*, or by the weight of our presents. Particular inquiry was made for pearls, and cups of crystal. Round the *Déba's* neck was a string of beads, thick in the middle, and squeezed in at the ends; each bead about an inch and a half long, of a black substance resembling elastic gum, and marked with a deep circular impression made by a kind of seal. At the bottom was a small oblong-rounded gold box, with a little turquoise stone in the middle of the lid. In each ear he had a long pendant, consisting of a large pearl, between rows of small turquoise stones set in gold. All the three persons mentioned had on their tail, which is twisted from three plaits, a gold circular ornament in lieu of a rosette. This is generally larger than a crown-

piece, half an inch thick, with a raised edge defended by very beautiful fillagree work, enriched with some decoration of the turquoise. This is really an elegant trifle, and with the exception of a dagger case, and an etui for long iron sticks to clean the throat of their tobacco-pipes, was the only real decoration betokening taste, I have seen in the country.

July 18th.—This morning we displayed our goods as detailed in our inventory. After we returned, a *Cashmírian Vakíl* from the *Rájá* of *Laták* sent word that he was ready to buy our goods, if the *Déba* did not close with our terms. He said that he should be glad to open a commerce with *Hindústan* for goods of that country in exchange for the productions of *Laták*. That place, he said, was about sixty cós or ten days' journey from *Ghertope*, and the same distance from *Cashmír*. He mentioned a place called *Baschar*, twenty days' journey from *Laták*, and ten only from *Bokhara*. The road through *Cabul*, from *Dehli* to *Bokhara*, he represented as very circuitous. From *Amritsir* to *Laták* the journey was from twenty to twenty-five days, and the best season for it was the hot weather or the rainy season, but it would be preferable to go in the former, and return in the latter period. He purchases shawl wool on advances at thirty *negís* per rupee; the first quality sells in *Cashmír* at twelve *negís*, and the second fifteen *negís* per rupee. The best wool comes from the neighbourhood of *Ouprang Kote*, near *Mánasaróvar*.

July 19th.—The *Latákís*, as well as the *U'niyas*, are not able to grow grain enough for their own consumption: but are supplied by the inhabitants of the hills. The *U'niyas* procure their grain from the *Jouárís*, the *Marchas*, and other traders, through the passes as far as *Baschar*, the *Latákís* from the *Cashmírians*.—The supply of grain is highly important to the *U'niyas*, as they live on barley-meal and rice, which they eat with

their tea. Animal food seems to constitute only a small portion of their diet.

The shepherds are now beginning to shear their sheep and goats. *Joudrí* and *Baschar* merchants are purchasing sheep wool, which they manufacture into *Pankís* and blankets; and those from *Laták* are collecting the shawl wool; I purchased a small quantity of the latter, at the rate of twenty-five *negís* per rupee. The *Latákís* require thirty. The *Déba* hinted that he might be disposed to give twenty; and this in the beginning it may be prudent to take, until a footing be established. It is important to shew, that he will receive more advantage by dealing with our agents in future, than with the *Latákís*. These have some shawl goats, but not in number sufficient to supply the *Cashmírian* market. However, if a portion of the quantity raised in *U'ndés*, can be diverted from the usual line, they may be compelled to keep more goats themselves. Still without much success, as the cold is not so severe in the neighbourhood of *Laták*, as to the eastward, in which direction the mountains are higher, and covered constantly with a large quantity of snow.

July 20th.—At a little distance from us, and close to the river, two people are engaged in preparations for making paper. They have two large bags of old paper, that has been written upon, and manufactured from the bark of the root of the *Latbarua*, formerly mentioned. A few large flat stones are placed near the edge of the water, where a portion of the stream has been divided from the main current by a low piece of sods. On the grass are two frames of wood, covered on one side with fine cloth, and the other is open, forming a shallow tray. The workmen begin by dipping some of the old paper in the water, then beating it upon a flat stone with a small round one, till it is reduced to a pulp. One of the trays is then placed in the broad part of the canal, leaving a space for the water to run under it. The pulp is put into

a geer pump with water, and worked into a paste; it is then poured on the cloth, and as this is sunk two or three inches in the stream, the water rises through the cloth into the tray, and, mixing with the pulp, dilutes it. The impurities, which swim, are picked out, and the pulp agitated by the hand until it is supposed to be sufficiently clear, when the current of water is lessened. The workman sees if the cloth be equally covered with pulp; and if any part look thin, he stirs the water with his finger immediately over another that is too thickly covered, and raises a cloud of paste which his finger leads to the thin spot, and by making a little eddy, the motion of which he gradually diminishes, the pulp is made to subside. By a repetition of this simple process, the sheet becomes of an equal thickness throughout: when it is carefully raised out of the water and placed horizontally on the ground to dry, till the greater part of the moisture is drained off, when it is gradually raised, and when nearly dry, the frame is set upright: when perfectly hard, one corner of the large sheet is raised from the cloth, and the whole detached by the hand. However, this paper is very inferior, as to evenness, to that made in *Hindustan*.

July 21st.—At about ten o'clock we were visited by three *Tatar* musicians from *Laták;* one played on the hautboy, another on drums, and the third sung and danced. The airs were very similar to those of the *Scotch;* and the tones of the hautboy resembled strikingly those of the bagpipe. This instrument had eight holes for the fingers, and one for the thumb, with two reeds, and a metal tube, with a broad flange concave upwards and convex downwards, in which the reed was inserted.—The reeds were tied together with a piece of string about two inches long, that the loose one might be ready to be changed instantly. The musicians began with an overture not unlike that of OSCAR and MALVINA, as far as comparison may hold between the execution

from two instruments, and that of a full band. They then sang the words without music, and so went on with the instrumental and vocal performance alternately.

The *Déba* and *Wazír* made their present, consisting of two large trays of rice, one coarse, the other fine; three lumps of butter, sewn in skins, and eight sheep. The butter was rancid, a circumstance which in this country does not lower its value. The exhibition of the articles of my small medicine chest, and of some surgical instruments, appeared to give much satisfaction; and both the *Déba* and *Wazír* were pleased with a few drops of oil of peppermint on sugar.

22d.—This morning I received a message from the *Déba* to visit him as soon as possible. He proposed a new rate of valuation for the coin, in which our advance for wool had been made to him. This proposal was a gross roguery, as we had weighed the rupees and found that one of them was equal to 4½ *Latáki Timáshas*, and had ascertained the goodness of the silver. He had too, of his own accord, offered to allow that rate. I told him, that we had placed the fullest confidence in his honour, and had considered the bargain of the day before as binding on both parties: however, we were in his power; and we wished him to receive the twenty-five rupees, which would have arisen out of the transaction, as it at first stood, in the light of a *nazar*. I declined giving five *Sirinagar Timáshas*, in lieu of a rupee, as I had been informed that the *Déba* alone refused them, and, probably, through the influence of the *Latáki* merchants. During the arguments on this subject, the young *Wazír* spoke to the *Déba* several times in an under voice, held down his head, seemed confused, abashed, and ashamed of the trick played by the *Déba*. The latter, obviously pleased with having carried his point, said, that heretofore no shawl wool had ever been sold except to *Latáki* merchants; that there was an order of government inflict-

ing the loss of his head on any man that should sell this wool to any other person; but that in consequence of our having come from a great distance, being, as he was fully aware, persons of consideration, and as he was pleased with our conduct, he had departed from the general rule, and had put us on the same footing with the *Látákís*: that we should, in future, be placed on the same terms as they; and he would engage that no third person should enter into competition with the two parties for this article. I expressed my satisfaction with his promises, and begged that he would give me a list of the things he might be likely to want from *Hindustan*, as the *Europeans* sent many articles of great utility and beauty to that country. He said, that a sword, and large pearls of a rose colour, pear shape, and free from flaws or irregularities, would be most acceptable. He gave me a drawing of one, which probably would be worth 2000 rupees, and which he valued at 3 or 400. After our commercial affairs were thus settled, he said that we could not have permission to go out of the usual road from *Ghertope* to *Mánasaróvar*, or to stay more than one or two days at that place. Thence we were to proceed to *Gañgrí*, afterwards to *Hienlung*, to take up our wool, then to return to *Dábá*, and enter the territories of the *Gorkhas* by the *Nítí* pass. I answered that we were ready to obey, to the utmost of our ability, the orders which he had prescribed; but that it had entered into our pilgrimage to visit *Jwálámuc'hí*, and that by the road of *Nítí*, we should make a round, to which our finances were unequal. He said, that the heads of the *Seyánas*, who had become sureties for us, should answer for our leaving the country by any other road. I urged every argument that occurred to me, but he was inflexible. He said his own head would be forfeited if he gave his consent to our returning by any other pass; and that our lives were held by him in equal estimation with his own; but that the case was without remedy. This blow was unexpected and heavy, as it places us in the alternative,

either of being exposed to be stopped by the *Gorkhális*, or of losing the benefits of the connexion we have formed with the governor of the *U'ndés*. AMER SINGH says that as the *Marchas* were our security here, so will they guarantee our passing by the *Baschar* road. To effect this, he says, it is only necessary to go one day along the *Níti* road when we leave *Dábá*, and then striking to the West, with a good guide, we shall reach the *Baschar* without inquiry or molestation ; or if we dislike this plan, we may go to *Níti*, and make an arrangement with the *Mana Marchas*, near *Bhadrínát'h*, to give us a guide. My companion thinks it will be best to go as far as *Tapóban*, and there striking over the great snowy *Tunsási* range, gain the province of *Budan*, and push vigorously for *Chilkea*. I prefer this, because we can see our cattle safe to *Níti*, and make an arrangement then for passing our cattle and goods through the *Gorkha* territory. The old pundit opines for the *Baschar* road, and says we shall neither be seen nor heard of by the route which he shall chalk out, until we reach a country in which we shall not be noticed. I rather apprehend that the prohibition has been caused by the inquiries which the old man has been frequently making from *Baschar* people respecting the state of the road: but, be it as it may, it is clear to me, that if we wish not to furnish to the governor of *Ghertope* a substantial reason for rejecting future communication with us, we must abide by his order in respect to quitting his country by the *Níti* pass.

Mr. H. went to the *Cashmírian*, and found that he was a *Wakíl* or agent of the *Rájá* of *Laták* for the purchase and sale of wool. He said that the amount of wool annually bought by the *Rájá* was between two and three lakhs, the greater part of which was resold to the *Cashmírian* merchants, who waited for the return of the *Wakíl* and paid for it immediately. Merchants from *Amritsir* took off the rest. In speaking of articles of merchandise which were marketable at *Laták*, he mentioned coral

beads, which formerly were brought from *Dehli* and *Benares*, and, though exceedingly dear, were resold into *Tatary* at a great profit. But within the last three years their value has fallen greatly, from the great numbers which have come through *Yárkund*. These have been brought by the *(Ooroos) Russians*, who have long been in the habit of trading with that country, and in the course of the last three years have pushed on a lively traffic into *Cashmír* through agents. The *Wakíl* said, that the *Ooroos* had not yet been at *Laták*; but the *Déba* of *Dábá* asserted, that kafilahs of 5 or 600 *Ooroos* on horseback had come to the fair of *Ghertope*. Now if this latter intelligence be true, the *Russians* must reach *Ghertope* by another route than that of *Yárkund*. The *Wakíl* said that the horses of *Laták* were much larger than those of *U'ndés*, but that the best were bred in *Yarkúnd*, thirty days' journey from *Laták*, and that *Bokhara* was fifteen days' journey from *Yarkund*: *Laták* is ten or twelve days' journey from *Ghertope*, and the same distance from *Cashmír*, and twenty-five from *Amiritsir*. Thus the road to the N. W. of the *Himálaya* from *Dehli*, would stand thus · from *Amiritsir* to *Laták* twenty-five days, *Yárkund* thirty, *Bokhara* fifteen; making a total of seventy days; a much shorter distance than that by *Cabul*.—In this route there are two days' journey, in which no water is to be met with; and for thirty days there is a track without inhabitants; but the road is safe. I must here remark that the river, which goes from *Ghertope* to *Laták*, does not proceed to *Bokhara* as before stated; but falls into the *Attock*, or more properly speaking, is the main stream of that river. Neither is it a fact, that *Cashmír* furnishes *Laták* with grain, as was at first reported to me; the latter country having sufficient land in cultivation for producing barley and other grains, except wheat and rice, which it obtains from *Baschar*. I went this evening to the *Cashmírian's* tent, taking with me two small bottles of essence of peppermint and of volatile caustic alkali. He received me

with great respect, spoke in the highest terms of the regard shown to medical characters in the West, and of the pleasure he had in our meeting, which he now regretted had not taken place before. His name was Ahmed Khan, Kazalba'sh, about forty-eight years of age, and of a respectable appearance. He placed before me some fine sugar-candy and a paper of saffron. Looking-glasses of large sizes were, he said, much in request in *Cashmír*. He was particularly desirous to have a lancet of the same make with one that I had given to the *Garpan*, but in this I could not indulge him. I drew him on to converse about the *Russians*, but could learn no more than what has been stated, save that a few have before been in *Cashmír*. He brought with him shawls of various kinds for sale; and said that his people, who were not come up, had some of great value in charge. Nobody, he said, could trade at *Laták* without the direct permission of the *Rájá*. We first supposed, that the *Cashmírians* came to *U'ndés* for part of the wool they used; and learning that they did not, were disposed to blame them for want of enterprise. However, it appears that they have not been permitted to trade directly with *U'ndés* by the *Latákís*.—A state of warfare had long existed, with intervening periods of peace, or rather truce, betw [illegible] these two states, in the reign of Mahmud Shah. The *Chinese Tatars* then invaded *Laták* whose inhabitants applied to the *Cashmírians* for assistance. These represented their state to the Emperor who ordered them to send some infantry to their aid. By their help the *Latákis* repulsed the assailants; and a treaty of amity was made between the conflicting parties, of which one article was that the shawl wool raised in *U'ndés* should be sold to the *Latákís* alone. This has since been little infringed upon, except two years ago, when the *Jouári Marchas* purchased a small quantity on account of Mr. Gillman of *Barelly*. The *Latákís* apprized of the transaction, complained to the government of *Ghertope*, who issued

the rigorous edict before mentioned, forbidding the sale of any except to the *Latákís*, on pain of death to the party selling.

23d.—Leave *Ghertope;* thermometer 38° at sun-rise. The night has been frosty. Having taken leave of the *Déba* or *Garpan* in the afternoon, and of the *Wazír* at night, we prepared to start. The *Wazír* treated us with much cordiality. He said that in a very short time he should go to *Lassa* to remain. In his apartment, which was a much better one than that of the *Déba*, were many trunks, and in the right hand angle was a small platform with benches in front, on the top of which was a brass image, before which a lamp was burning, and grain of various kinds was served on salvers of wood.—On the lowest step were several plain wine-glasses reversed, which, from their clumsiness, I supposed to be of *Russian* manufacture. He shewed us the picture of the late *Lama*, executed in silk; but both the form of the person, and the countenance, announced more of the female than of the other sex. This character I have remarked to have prevailed in every portrait of the many different *Lamas* which I have seen; and were it not that no mention has been made of this personage having been emasculated, I really should have imagined this to have happened. However, taken out of the hands of his parents in infancy, educated in the entire subjection of the passion of sex, and kept in a state of little less than entire confinement, with full feeding, it is not surprising, that the features of the face should have little of the virile character, and that the whole contour of the body should contract a feminine softness undistinguished by the bold variety of swell and fall belonging to a muscular frame accustomed to exercise.

At 3985 paces reach two piles of stones, the uppermost of which were engraved with a character, that appears different from that in common use, and appropriated, I

presume, to religious purposes. The valley here narrows and is bounded by mountains, whose tops are more or less covered with snow, and it takes a winding direction to the left. At 5407 paces arrive at our ground of encampment near some tents, and a considerable herd of yaks with a flock of the finest sheep I have seen in *Tatary*.—Pleased with the prospect of having my choice from amongst the best collection of cattle of every kind I had seen, I rambled through the whole, and made choice of several female yaks and calves as also of young goats, which however were not equal in quality to the yaks and sheep.

The horsemen, whom I discovered, too late, to be intoxicated, said that they had no orders to allow me to pick out of the flock; but would send for instructions on that point.

24th—Thermometer 44°. At an early hour ordered the pundit, sircar, and interpreter to proceed to *Ghertope*, and represent to the *Déba* and *Wazír*, how we had been treated; as also to mention that the horsemen had said, that as they had received only four days' pay, we must travel day and night. We had scarcely determined upon this measure, when the horsemen sent word, that a message was come from the *Déba*, importing that he would send another draft of each kind; and, if I did not approve of them, I might take back the articles he had purchased. I directed them to offer a higher price for the power of selection; but rather to take such cattle as he should offer, than on our part to break the original bargain. In the evening my messengers returned with eight cows, and the same number of calves, of which four were bulls.

July 25th.—Thermometer 41°. March at 8^h 10′. The river we have left comes from N. 85° E. The mountains in this thoroughfare for the most part covered with snow. The breadth of the valley in which the

stream runs, is about 3½ miles. Thermometer at 1 P.M. 82°. The road on which we are proceeding seems a great thoroughfare; many *Baschar* and *Jouári* merchants having passed to-day with loaded sheep, goats, and yaks, towards *Ghertope*.

July 26th—Rain. Thermometer 43°. The changes of temperature in this climate are extremely sudden. Last night the mountains to the right were bare; this morning they were covered with snow. Thermometer in tent 74°, at three P. M. rain; alternate sun-shine, overcast sky, wind, and thunder.

July 27th.—Thermometer 39°. At noon, all our baggage being dry, commence our march. The river from this spot runs N. 70° W. about 1¾ miles, and then takes a turn to S. 80° W., and joins the river along which we went to *Ghertope*. At 4460 paces cross the river three feet deep, rapid, with large slippery stones; water very clear. At 6260, thirteen wild horses grazing to the left. At 7957, came to the bank of the river, which we cross, about 2½ feet deep, 80 yards broad, and very rapid. At 8200, reach our ground and encamp. The valley well furnished with grass.—Several *Tatar* tents, and cattle grazing.—Much furze on the adjacent hills. River comes from N. 75 E., and runs N. 50 W. for about 1¾ mile, when it takes a turn to the S. 75 W. and forms one of the principal branches of the *Ghertope*, supposed to belong to the *Attock*.—Wind very cold, raining all around. The river rose rapidly, and the *Tatar* horsemen refused to cross their horses, in order to bring over some of the people who had stayed to conduct our goats and sheep across the river. The yaks were sent in, who stemmed the current. Some clung to the tails of the animals and came over easily; the others, more timid, preferred retreating to some huts at a distance, where the *Tatars* gave them milk and lodging.—A few drops of essence of peppermint on sugar to the *Hindus*, and a dram of

brandy to the *Musselmans*, with strict injunctions that they should run about, and not approach the fire till warm, prevented any of the persons who had been much exposed to the cold from suffering by it.

July 28th.—Thermometer at sun-rise 44°; obliged to wait until ten o'clock, before the river had sunk sufficiently to admit of the men, and a few goats which were left, passing over. At 1^h 20′ march. The mountains have the particular red appearance indicating the presence of gold; and though adorned with little verdure, are picturesque in their forms. Cross several small rivulets which come from the left, and fall into several ponds to the right:—air very cold. At 7050 paces reach a pile of stones covered with inscriptions. At 8160, road crosses several dry watercourses, and ascends to the summit where are two small heaps of stones, over which is a line covered with slips of rags, and supported by two sticks. At 9460 paces cross a rivulet formed by fresh-melted snow. This rises on the left and runs to the right. Reach our ground, 10,066; at 5^h 20′ very cold, windy and cloudy.—A storm rises in the N. W. attended with thunder and small hail. Thermometer 47°. Hail changes to rain, which falls steadily till 7 P. M.

To-day I heard a strange, sharp and loud noise proceeding from the side of a hill, at the bottom of which the road ran.—It seemed between a bark and a howl, and expressed much anger. For some time I could not make out whence it came, but, whilst casting my eyes on a furze bush, an animal about the size of a middle-sized dog sprung from a hole underneath it, about fifty yards up the hill, and after surveying the passengers and repeating his yelping, retreated with precipitation into his cave, as soon as he saw me jump from the back of a *Chownr*.—His general colour was a yellow brown. His head was round with small ears, his face burned light and dark-yellow, and his tail long.

July 29th.—Thermometer 37°. At 9^h 45′ began to hail, which soon changed to rain, and lasted until 10^h. We began our march at 10^h. 45′. Mountain on the left covered with snow: many wild horses grazing on the high Table Land. At 16,652 paces reach a branch of the *Satúdrá* river which I forded here, and again at 16,868, much against my will, as it was extremely cold; but my yak had played some tricks, which in my weak state of health I did not think prudent to experience more than once. At 7^h 15′ reach *Misar*, very cold and much fatigued. Thermometer 46°.

July 30th.—Halt at *Misar*. Thermometer 44°. In the forenoon, 8 yaks arrived laden with shawl wool and accompanied by two persons on horseback—one of these was an officer called a *Nerba*, who had received orders from the *Garpan* to supply the quantity for which we had made advances. The morning was hot, a circumstance in our favour, as the sellers of wool are in the habit of wetting it, under an idea, as they pretend, of its twisting the closer, but more probably to make it weigh heavier. However, after a little delay on our part, that the wool might dry as soon as possible, we had it weighed by a pole with a weight, on the principle of the steel-yard, which the *Garpan* had sent with us. As more was brought than we advanced for, we agreed to take it, on the principle of encouraging the *Garpan* to give more another year. The surplus amounted to 38 rupees and 1 *Timásha*; and the *Garpan* had ordered rupees alone to be received, which shewed that he had given directions for more to be brought than we had contracted for, in order to try whether we really meant to purchase, or used the plea merely in his presence to mask other designs.—At this place we found many *Jouári* and *Dhan* merchants, who were troublesomely inquisitive as to who we were, what could be our motives for coming, and why we purchased shawl wool. The sight of some of our wares seemed to convince them, that we were what we appeared

to be. I consider this day as the epoch at which may be fixed the origin of a traffic which is likely to be extremely beneficial to the Honourable Company.

Misar has only one house, made of bricks baked in the sun, and 5 tents of goat-herds: it is situated upon a rising ground upon the left bank of a rapid stream, forming one of the branches of the *Satúdrá* or *Setlej*. This stream comes from N. 86. 5 E. and runs down a valley about 2½ miles in breadth and near 8 in length, running S. W. After a course of about ½ mile, it joins that which we forded yesterday.

July 31st.—Thermometer 34°. Ice ⅜ of an inch thick. The changes of temperature, so frequent and rapid in this climate, require that the quadrupeds naturally belonging to it should have some very warm clothing, to protect them against their ill effects; and we find that this has been very liberally bestowed by nature. The sheep has a very thick and heavy fleece; the goat has at the root of his long shaggy hair a very fine fur interspersed generally; the cow has a material of the same kind, not much inferior in warmth and softness, which I apprehend might prove a substitute for beaver; the hare has her fur of peculiar length and thickness; and even the dog has a coat of fur added to his usual covering of hair.—The wild horse (*Equus Quagga**), the wild ass (*Goorkhen, Onagre*), and I believe the mule, the offspring of these animals †, are found in abundance on the mountains of *Tatary*; but whether they have any thing of the fur kind I cannot say; but that animal, which is here called the *Baral* ‡, and which seems to have many characters of resemblance to the deer as well as to the

* Probably *Equus Caballus*, which inhabits in the natural state, the deserts of great *Tatary*. C.

† *Equus Hemionus*; which much resembles the mule. C.

‡ *Ovis Ammon?* C.

sheep, has certainly at the bottom of the brittle hair of the former the most beautiful brown fur I ever saw.

This morning the *Nerba* came to take leave of us, and as his behaviour had been uniformly attentive, I was desirous of shewing him that we were sensible of it, and accordingly gave him a double-bladed knife and my sword. The latter was, in fact, no great gift, as it was bought at *Najibábád* for three rupees, and was intended solely for the journey. He was, however, highly pleased with the compliment. His name was T'HAR-CHAND; and he said, that he was in the suite of the *Wazir*, and should accompany him to *Lassa*. He wore a pendant in one ear, in which, along with rows of small turquoises, the never-failing ornament of this part, was a large irregular pearl, such as are in high request in this country, on account of their size. These I understand are brought to *Calcutta*, in considerable numbers during the rainy season, from the *Lackadive* islands, and sold at a very easy rate. The *Nerba's* outer garment was woollen, of green, red, blue, and yellow narrow stripes, manufactured at *Guinak;* under this were four other garments; and both men and women constantly load themselves with several vests to prevent suffering from the cold.

On the back of this habit, and on the right shoulder were sewed the saw, adze, chisel, rule, and all the insignia of Free Masonry in iron; the symbols of a fraternity, of which he said he was a member. I purchased from him some gold-dust at the rate of 40 *Sirinagar Timáshas* for the *Fitauk* of 7 *Mashas*. The *Nerba* appeared to have gold-dust to the amount of about 5000 rupees; and it was understood, that every person, willing to become an adventurer in the gold mines, pays to the chief of the district one *Fitauk* as an entrance fee, and all lumps above a certain weight. This occupation is more profitable here, than in most other places; as though the gold-digger works only three months, he expects that the

result of his labour should keep him the whole of the year. Leave *Misar* at ten A. M., having loaded our wool upon the yaks which brought it, and for the hire of which the *Nerba* would receive no gratification; the first instance of disinterestedness I have witnessed in this country. At 4500 paces enter *Tirtápúri*. At 4525, pass several piles of stones inscribed as is usual, and some figures carved in stone and painted, Reach the summit of the height at 4575 paces and encamp.

TÍRTA'PU'RÍ is the residence of a *Lama* and several *Gelums*, who live in separate houses made of rough stones, and follow a pastoral life. It is perched upon the top of an eminence, about 200 feet higher than the plain, and has Table Land running from it eastward. Steep, craggy, lime stone rocks in a state of decomposition immediately overhang it, threatening some of the houses with destruction at no distant period. Insulated pillars, which have resisted the influence of the weather longer than the softer portions of stone by which they were surrounded, seem upon the very point of falling; but apparently give no alarm to the inhabitants.—Still higher, and losing their heads in the clouds, are pointed mountains, which from their brilliant whiteness, appear to consist of chalk, covered here and there with a layer of yellow ochre. Immediately at the foot of the rock, on which the buildings stand, runs a very rapid stream, which is said to proceed from a lake at the foot of the *Himálaya*, called *Ráwanhrád*, and to constitute the principal branch of the *Satúdrá*.

To the west of the town, and about a quarter of a mile distant, are the hot springs, forming one of the most extraordinary phænomena, I have ever witnessed. From two mouths, about 6 inches in diameter, issue two streams, bubbling about 4 inches higher than the level of the stony substance whence they escape. The water is very clear, and so hot, that the hand cannot bear to be put into it for an instant; and a large volume of smoke curls round

them constantly. They burst forth from a table of calcareous stone nearly half a mile diameter, and raised in most places ten or twelve feet above the plain on which it stands. This has been formed by the deposit from the water of the springs whilst cooling. Immediateiy surrounding the springs, the stone is as white as the purest stucco. The water flowing over a surface nearly horizontal, as it escapes from the vents, forms shallow basins of different size and shape. The edges of all these basins are curiously marked with indentations and projections, like the tops of mushrooms and fleurs-de-lis, formed by calcareous matter prevented from uniting in one uniform line by the continual but gentle undulation of the water entering into and escaping from the several basins which are emptied by small and successive falls into the surrounding plain. By degrees, however, the fringed edge becomes solid, and contracting the basin, of which the hollow fills likewise, the water takes a new course and makes new reservoirs which in their turn become solid. Although the water appears perfectly transparent, the calcareous earth, which it deposits, is of different colours; in the first instance, near the mouth, it is delicately white without a stain; at a little distance it assumes a pale straw tint; and further on, a deep saffron hue: in a second the deposit has a rosy hue, which, as it recedes from the source, becomes of a deeper red. These various colours are deposited in the strata, which hardening, retain the tinges they received when soft; and give rise to variously stratified and veined stone and marble. The whirls, twists, knots, and waves, which some of the fractured edges exhibit, are whimsically curious, and shew all the changes which the stony matter undergoes, from soft tufa to hard marble. I observed that the marble is generally formed in the middle of the depth of the mass, rising up with nearly a perpendicular front of the height beforementioned; the table must have been the work of ages. The calcareous matter, which is so largely dissolved and suspended by the water whilst hot, is probably fur-

nished by the chalky mountains above *Tirtápúri*, but the origin of the heat, I have no clue to discover. The water must be most strangely situated, for two streams so inconsiderable to throw down such a prodigious quantity of earth; and the surface where quiet is also covered with a thin crust of semi-transparent matter like that which rises on supersaturated lime-water.

At this place, I left the wool which I had obtained at *Misar*. The *Lama* was absent when I took the liberty of depositing the wool in the verandah of the temple of one of the deities; therefore it remains to be seen, should he return before I do, how he may approve of this step. However, from what I have seen of the priesthood here, they are an inoffensive class.

Nearly opposite to his house, is a broad wall of stone, 150 yards long and 4 feet broad, covered with loose stones inscribed with prayers. The length of time which must have elapsed, before such an extent of surface could have been so decorated by the hands of pilgrims, shows the great antiquity of *Tirtápúri*. There are many little *Mat'hs* having niches in one side, in which are impressions, in unburnt clay, of *Lamas* and deities, and on some of the piles of stones are figures of *Lamas*, of *Náráyan*, and of *Bhasmásúr*, carved on large flat pebbles.

August 1st.—Thermometor 40°. Leave the yak, cows, calves, and my goats.—Commence our march at 10 A. M., meet a party of *Unias* going with several loaded yaks to the fair at *Ghertope*. The manes of the yaks were died yellow with the *Geru* earth. At 12,800 paces come to our ground and encamp in a green pleasant spot, in a hollow surrounded with many springs, at 4[h] 30′ P. M. At 8 P. M., Thermometer 46°.

August 2d.—Thermometer 32°. A severe frost during

the night:—ice a quarter of an inch thick over standing water. March at 10^h 20′. At 10,825 paces a large sheet of remarkable blue water, at the foot of the mountains to the right, called *Ráwanhrad*, said to give rise to the principal branch of the *Satúdra*, and to communicate by a river with the lake *Mánsarówar*, named by the natives *Mapang*. *Ráwanhrad* bears S. 25 E. distant 8 miles. At 16,827 paces halt and encamp at 5 P. M. At 7 P. M. thermometer 47°. This day we saw more wild horses than on any former one, also several wild asses of the kind called *Gúrkhar*, and likewise I believe some mules. The asses are a little less than the horses. Saw likewise *Barals* and many yaks.

August 3d.—Slight frost, thermometer 34°. March at 9^h 50′. At 7287 paces, cross a stream over a wooden *sankhoo*. At 7325 encamp on a high spot. This is *Gangrí* or *Darchan*. There are four houses of unburnt brick or stones, and about twenty-eight tents, amongst which that of the servant of the *Latákí* agent is apparently the best. Sixteen years ago, the old pundit says, this was a place of consequence. There we find many *Juarí* and *Dhermu* merchants with grain, and three tea merchants, who say they are acquainted with *Pekin* which they call the capital of *Mahάchín*: but they themselves reside two months journey beyond *Pekin*. *Tatars* of the districts we have seen, wore their hair plaited: these people had it cut all round, so that it hung low and loose in their necks, and they wear coats of kid skins made soft by rubbing, and the hair turned inwards.

A cascade issues from the rocks just above *Darchan*, and falls into the *Ráwanhrad*, which is supplied by the melting of the snow on the great mountains at the foot of which it is situated. It is said to surround a considerable extent of mountains, insulating them completely; but this, being the relation of natives, is to be received with caution.

August 4th.—Thermometer at 7^h A. M. 57°. We were resolved to stay here to-day to recruit my strength, which stood much in need of it after frequent attacks of illness.

August 5th.—Thermometer 48°. Leave *Darchan* or *Gangrí* at 10^h 30′. At 2675 paces cross a stream which in five or six branches comes from the *Cailás* mountains and disembogues itself into the *Ráwanhrad.* At 13,235 paces reach the top: see a fine looking wild horse.—Descend to five tents: a wild ass grazing close to us, and a prodigious flock of sheep and goats. The lake of *Mánsarówar* or *Mapang* now appears at the foot of a long declivity of pasture bounded by immense mountains towards the South, and, having in front terraces of stone with the usual inscriptions, and a house inhabited by *Gelums.*

August 6th.—Halt on the bank of the lake *Mánsarówar*. Morning early, thermometer 47°. This lake is considered as the most sacred of all the places of worship in the opinion of the *Hindus*, founded probably on the difficulty of access to it, not merely on account of its distance from *Hindústan*, and the ruggedness and dangers of the road, but from the necessity of every pilgrim carrying with him money and provision, which latter he must occasionally eat without any preparation on account of scarcity of wood. Few *Jógís* can afford the expense of this journey; and I met with two on the road, who must have returned for want of funds if I had not borne their expenses. The name is derived from *Mán** and *sarówar*, a *Sanscrit* word signifying a lake. The story upon which this appellation is founded is related at great length in the *Sástra.* Why it is called *Mapang* by the *Unias* or *Chinese Tatars*, I have not been able to

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* At full length *Mánasa*, divine · made by BRAHME, named MANAS, the mind, emphatically. C.

learn: but it is considered by them an act of religious piety and duty, that the nearest relation of a dead person should carry a portion of the ashes of the deceased, and empty them out of a small bag into the lake, as is practised at *Hardwár*.

Hindu geographers have derived the *Ganges*, the *Satrúdrâ* and the *Kálí* or *Gogra* from this lake; and as I believe no *Europeans* ever before visited it, I was anxious to ascertain whether it really gave rise to the two last mentioned rivers or not.—As to the former, it is quite clear from the observations made in this journey, coupled with those in the trip undertaken at the suggestion of the late Colonel COLEBROOKE, by Messrs. RAPER, WEBB, and HEARSAY, that the *Ganges* derives its supplies from the melted snow of the mountains of the *Himálaya*, and a thousand small streams, which fall into its various branches during their passage from these stupendous rocks, to the great common mouth at *Hardwár*: and that it does not receive the smallest streamlet from their extreme Northern face, nor from a source to the Northward of them.

HARBALLABH, the old pundit, reported, that near the South-western corner, a river issued from it, which flowing in a westerly direction went along the *Ráwanhrad*, and escaping from its Western extremity near the foot of the great mountain, formed the first branch of the *Setlej*. Yesterday evening I mounted upon a very high bank, and thought that I perceived distinctly the whole of the line of the shore, without seeing any outlet, with the exception of a space near the S. W. angle which a projecting rock concealed from my view. Determined not to leave this point in doubt, I took a fishing rod and gun, thinking that I should have time to amuse myself a little in one or other diversion and return by the evening.—At about ten I began my march; and, although very weak from the frequent attacks of fever to which I

had lately been subject, I felt confidence that I should accomplish the object without any material degree of fatigue.—As we were encamped about the middle of the northern side, I walked along the shore towards the West.—The beach was formed of fragments of stones rounded, and thinned when of small size, by the continual action of the waves: but in some places great masses of red and green granite, marble, and lime-stone, had fallen from the face of the rock, which in many parts was 300 feet perpendicular. These stones, frequently washed by the surf, and glazed by the sun, afforded a very unsafe footing: however, at this time it required only care to prevent falling, which would have endangered a limb, as some of the spaces betwixt the stones were very deep. The steep bank was here and there cut by profound and precipitous watercourses, now dry; but occasionally serving to convey the snow-water from the high tables upon the head of the bank into the lake. The front of the bank at the height of from ten to thirty yards, had houses of loose stones and wood built in recesses upon ledges; but, as there were no stairs to them, I thought them inaccessible to human beings, except by means of ladders, of which I saw none. They were inhabited, as I beheld smoke issue from many, and are I presume the secluded retreats of monastic recluses of both sexes. One of these nuns accosted me by the name of *Guni Lama*, and returning along with me, pointed to one of the rock habitations, which I concluded to belong to her, and appeared by her gestures to invite me to it. However I was so ungallant as to refuse the lady's hospitality: for I cannot suppose that she had any other motive for her civility than to offer me refreshment, or to ask charity, the disposition to which, the view of the inconveniences she was subjected to, by such a lodging, might possibly excite. A weather-beaten face, half stripped of its natural covering by the joint action of a hot sun and cold wind, blistered lips, a long bushy beard, and mustachios, in a country where the former is carefully plucked out,

with a gait not of the firmest, had probably raised emotions of pity, and induced her to think I might stand in need of repose. Be it as it may, with the most cordial salutation and expression of thanks by dumb show, I took my leave, and went on with my survey.

After an hour's walk, the beach changed to a deep sand, in some places pure and in others mixed with pebbles. That on the water's edge was bordered by a line of wrack grass, mixed with the quills and feathers of the large grey wild goose, which in large flocks of old ones with young broods, hastened into the lake at my approach; and though I fired several times with buck shot, few took effect, from too great distance. These birds, from the numbers I saw, and the quantity of their dung, appear to frequent this lake in vast bodies*, breed in the surrounding rocks, and find an agreeable and safe asylum, when the swell of the rivers of *Hindústan* in the rains, and the inundation of the plains, conceal their usual food. Many aquatic eagles perched upon the crags of rock; and several kinds of gulls skimmed along the skirts of the water. An unusually large body of great black gnats along the beach rendered walking troublesome, from their aiming to get into the nose, mouth, and eyes: but, when the wind lulled, which it did for half an hour, they flew along the surface of the water, and became the prey of a kind of trout without scales, which rose at them with extraordinary voracity, and with which the water seemed to be literally alive. I hoped by rounding the N. W. corner to have had sport by throwing across the wind; but it then suddenly chopped about, and a heavy surf beat upon the Western shore. As the bank approached this angle, it declined to gentle elevations, leading to inter-

* From the known resort of the grey goose (the swan of *Hindu* poets) to this lake, the bird is called in poetic language *Manasaucas*, or he, whose abode is the *Manasa* lake. *Am. Cosh. b.* 2. *c.* v. *v.* 23. C.

rupted Table Land, and at its base was a large bay, from the bottom of which rose a pyramidical red rock, connected with a line of ridge of high land to the higher flats to the North, and steep towards the South. Upon this was the house of a *Lama* and many *Gelums,* pitched in situations which produced a romantic effect, not a little heightened by streamers of various coloured cloth and hair, floating from high poles fixed from the corners and roofs of the houses. Leaving this and diverting my steps to the South, I went along the base of granite rocks amongst such troublesome, rugged and slippery stones, as had interrupted my progress in the outset, till I reached a high, level, and firm bank, which separated the water of the lake from that which accumulated by the slope of the surrounding upland, directing the melted snow into it. At the end of this natural barrier, I saw a point of rock running into the lake, from the top of which I flattered myself, I should have a prospect that would command the whole of the shore to the S. W. corner, and put an end to a task which I now found somewhat too much for the little strength I possessed.—But I was severely disappointed: for on mounting a steep hill, of which the point in question formed the front to the lake, another large mountain intervened to prevent my view, with a deep valley between it, and that which I had too hastily concluded would finish my labour. When I had reached the summit of this, another equally high presented itself. My servants were much fatigued; for my own part, I was obliged frequently to lay down: and it was four o'clock when I reached a small religious pile, whence I got a fair sight of the shore I was so anxious to see, with the exception of a very small portion that was intercepted by the projection of a high bluff angle starting into the lake: unable to proceed from the aching of my limbs and intense thirst, which I could not gratify, I sent a trusty *harkárah* to explore the angle which was concealed from my sight. The sky, which had frequently been overcast and disturbed with violent gusts

of wind, now became clear, and sunshine illuminated the whole of the circumference of the lake, so as to enable me distinctly to define every portion of its shore close to the edge of the water, and up to the foot of the mountains by which it is embayed, with the exception of the point to which I had directed the *harkárah* to proceed: there were numerous traces of watercourses leading into it, the most important of which was the *Krishná* sweeping down a ravine between two high mountains of the *Himálaya* range, and expanding like a sheet as it approached the verge of the lake; but not a break, nor any other appearance indicated the escape of any river or even of any small stream from it.—Although this was clear enough to the naked eye, I employed a telescope; and this as well as the evidence of two servants who gave me an account of what they saw, shewed that the *Mánsarówar* sends out no rivers to the South, North, or West.

At half past four I began to return, and descended to the shore, which was a bed of round pebbles that had fallen from the side of the mountains. Large masses of these stones, imbedded in a hard cement like old firm mortar, in some places obstructed the path, which apparently was more used by yaks, than trodden by the feet of man. I was in hopes that I should be able to reach the N.W. corner before the fall of night; and by ascending the high Table Land, that formed the summit of the Northern bank, avoid the deep sand and dangerous stony beach which I had traversed in the morning. Walking upon a flat surface, in some degree relieved the active aching and spasms of the thighs and legs, brought on by great exertion in climbing and descending, but did not take away the soreness of the muscles. However I laboured to the utmost extent of my power, but was much impeded in my progress by a strong wind which poured into the lake with vast impetuosity from the West, and rendered breathing difficult. Since morning the wind

had shifted four times, and had only been a little still for half an hour. In spite of all my endeavours, I could not attain the granite rocks to the S. of the *Lama's* house, before night came on; and by another sudden change of the wind, the surf was thrown so high on the shore, as to efface all traces of the path, and leave scarcely room enough to pass between the face of the rock and the water.—In a small recess we lay down for a few minutes; and as I had not seen the surface of the high land on the North, and the night was dark, I thought it, on the whole, more advisable to encounter the fatigue of wading through the deep sand, and the risk of injuring our legs and feet amongst the stones, than have the chance of falling over the precipice of the rock, or into any of the deep ravines by which its surface was broken. But there was another inconvenience, that was unforeseen and very annoying. The wind had put in motion the dry sand on the western extremity of the northern shore, and this rose into our eyes and almost blinded us.—The servants who were with me, had eaten nothing since the day before; I had only taken a cup of tea in the morning; and, though in health, they were little less exhausted than myself. For my part, from the violent pain in my limbs, and the singularly accelerated action of breathing, I was compelled to sit down every ten or fifteen minutes; and was in one of these halts overtaken by my *harkárah*, who reported that he had gone nearly to the foot of the *Himálaya* mountains covered with snow, and had not seen the smallest trace of any river issuing from the lake. At half past eleven, benumbed with cold, and completely overcome with fatigue, I reached my tent, where a cup of warm tea was a most welcome refreshment.

August 7th.—Thermometer 49°. Found my eyes inflamed; and observed that those who were with me, had also suffered in the same organ. Sent for HARBALLABH, and observed to him that the river which he had crossed on *Sankhos* sixteen years ago, did not, as he supposed,

proceed from *Mánsarówar*, but from some part of the *Himálaya* to the west, and taking suddenly a western course, fell into *Ráwanhrad*, and led him into error on this point. He was very positive on the subject; said he could bring the evidence of all the inhabitants of the neighbourhood in support of the truth of his assertion, and that my *harkárah* had not gone as far as I ordered him to do. To settle this matter, the same *harkárah*, and HAR DEO, the young pundit, were directed to proceed as far as the south-west corner. At half past eleven at night, they returned much fatigued, and suffering from the cold.—They stated, that they had gone beyond the south-west corner, and within 500 paces of the *Krishna* river on the south side, without finding any appearance of a river issuing from the lake, or of any former bed of a river which had escaped from it. The distance of the *Lama's* house from our encampment was 3521 paces; from the former place to the foot of the mountain, from the top of which I made my survey, 12,500 paces: they went 5000 paces farther, making in the whole 21,621 paces, or about eighteen *English* miles; which, doubled by their return, made their day's journey thirty-six miles. According to their calculation, my journey consisted of twenty-four miles: but adding the crossing of the hills, it may fairly be estimated at three more. The distance altogether is but trifling; yet the circumstances of my weakness from previous illness, the badness of the road, being benighted, &c., rendered its performance very distressing.—However, the fact of *Mánsarówar* giving rise to no large river, has been ascertained by it. The old pundit remained much dissatisfied with the decision, and a *Latáki* traveller asserted, that eight years ago the stream, which he mentioned, actually existed; and that it since that period dried up, and the bed has filled. Perhaps an earthquake may have been the agent in this effect. I believe the period assigned tallies with that which was so mischievous at *Sirinagar*; and it might have extended to this place.

Mánsarówar or *Mapang*, of which we had no means of ascertaining by astronomical observation, the exact geographical situation, is bounded on the south by the great *Himálaya,* which pours its liquified snow into its basin; on the East by a prolongation of the *Cailás* ridge; and on the north and west by very high land under the form of mountain, table, ravine, and slope, all declining towards it. In form it appeared to me oblong; the sides of the east, west, and south, nearly straight; that of the north, and especially to the north-east, where there is a plain at the foot of elevated land, indented, and irregularly tending to the east. The angles were not sharp, or its figure would have approached nearer to a square than any other; but it may be considered as an irregular oval. Its breadth from south to north, I estimate at about eleven miles; its length about fifteen. The water, except where disturbed by the wind near the beach, where it is sandy, is clear and well tasted. No weeds are observable on its surface, but grass is thrown upon its banks from the bottom.—The middle and sides farthest from the spectator reflect green; and, taken altogether, it has a noble appearance, whether in an agitated or a quiet state. We had, however, but little opportunity of seeing it unruffled; for the changes of temperature of the atmosphere are here extremely frequent and sudden, attended with great mutability in the wind.—Considering the heat of the sun in the middle of the day, the vast bodies of snow on the summits of the neighbouring mountains, which produce their influence when the sun begins to decline, and the breaches and gulleys through the ranges of hills, it is not surprising that there should be an almost continual conflict between opposite currents of air, or that the shifts of temperature should be frequent and great.—At what season this large basin is most full, I could not learn; but I apprehend this must be the driest season, as the greatest part of the water-courses which I saw were dry. But I found no appearance of water-mark above four feet higher than the

present water line; which would be wholly insufficient to produce any overflow of its banks.

I saw a great number of skeletons of yaks between the low and high water-mark; and, although the bones of the trunk and limbs were bare and bleached, the head was in almost every instance, and particularly its fore parts, covered with the skin, to which the hair adhered. I could get no account of the cause of the number of the carcases; but think it probable, that in the severe season the space between the banks and the water is filled by drifts of snow, and that the yaks going towards the lake fall into them, and are suffocated. Adverting to the instinct and experience of this animal, this solution may be erroneous; but I have none better to offer.—At first it occurred to me that they might have been sacrificed: however inquiry did not bear out this conjecture; nor could I discover any ground for thinking that these creatures are subject to epidemical diseases, which might have compelled them to resort to the lake, either to quench their thirst, or to alleviate their sufferings by bathing. With regard to the preservation of the skin in the fore-part of the head, this would soon dry from the influence of alternate heat and cold, there being little muscular substance between it and the bone to become soft and enter into putrefaction.

August 8th.—Begin to return towards *Hindústan*. Thermometer 45°.—Mr. H. cut his and my name on a stone, and left it in a secure place. At eleven A. M. march. At 9100 paces pass tents of *Tatars* and *Juáris:* cross a watercourse, at 10,200 paces, which was dry, when we went towards *Mánsaröwar*, but is now two feet deep. At 12,126 paces encamp near seven or eight tents. The valley of *Gangrí* is about twelve miles broad, and nearly twenty-four long. At the eastern extremity is *Mánsaröwar:* opposite is *Ráwanhrad.*—The latter lake has always been represented as surrounding some

large portions of rock, a little detached from the great *Himáchal:* however, the view which I had of it, completely destroys this idea. It consists of two legs, which are long, and not very broad; one leg runs eastward towards *Mánsarówar*, is straight, and ends in a point; the other goes to the south amongst the hills; and their divergence, forms an angle almost directly opposite to the town of *Gangrí* or *Darchan*. I think I saw a stream issue out of it at the western side of this angle, which probably communicates with the many streams which form the *Setlej:* but this point I purposed to make out decidedly.

August 9th.—Thermometer 42°. I suffered much from fever, and was unable to go to *Ráwanhrad*. About sun-set the wind became very high, and thick clouds, with loud peals of thunder, announced the approach of a storm.—This began with hail, turned to rain, and at midnight a fall of snow took place, which lasted till morning.

August 10th.—At six in the morning, thermometer 32°. Our tents covered two inches thick with snow, which continues to fall. The streams on the plain much swollen, many parts covered with water that were quite dry yesterday. The ground very poachy, all prospect of visiting *Ráwanhrad* given up, and anxiety felt, lest a continuance of this weather should fill the passes of the *Himáchal* with snow, and exclude us from *Hindústan*. *Ráwanhrad* receives many rivulets from the southern face of the *Cailás* ridge; but a large body of water, it is probable, falls into it from the northern front of its snow-capped neighbour the *Himáchal* range.—I much regret to leave unsettled the question of a branch of the *Satudrá* proceeding from it; but must bow to the necessity of the case.

On its banks vast numbers of wild geese are bred, and it is probably better stored with fish than *Mánsarówar*,

as one edge of its banks is fringed with grass of considerable height, and there is swampy land at the mouths of the streams, which empty themselves into its bosom. At a distance its water was of an indigo blue. The eastern leg appeared about five miles in length; of that of the southern one I could form no opinion, as it was lost in the mountains. The name is derived from *Ráwan*, so much famed in the *Rámáyana*, and the *Sanscrit* word *hrad*, signifying lake. The principal streams which rise in the *Cailas*, and disembogue, are, 1st, the *Siva Gangá*; 2d, *Gauri Gangá*; 3d, *Darchan Gadráh*; 4th, *Cátyáyaní*; and there are many others without names. It is said to be four times as large as *Mánsarówar*; but of this I can give no opinion. We have been forced to remain here all day. At nine the snow ceased to fall, and was followed by rain that continued till three. At twelve, thermometer at 62°. At sun-set rained again; thermometer 43°. About midnight the rain ceased.

August 11th.—Thermometer 42°. March at 9¼, over a plain which is very poachy. Our yaks, though very strong, labour through the soft ground, into which they frequently sink up to their bellies; but if left alone, would feed and wade along. *English* oxen would be much distressed and frightened in such quaggy soil. A hail storm induces us to halt at 9825 paces, near a small river, at three o'clock. Thermometer, Even. 49°. *Cailás* mountain is supposed to be the favourite residence of MAHA'DE'VA, and is situated opposite to the great lake of *Ráwanhrad*, and little distant from that of *Mánsarówar*. As its summit is always clothed with snow, it is but a cool seat: however this cold is said to be necessary, on account of the poison which has heated his frame ever since he swallowed it at the period of the *Sankh Avatár*.

August 12th.—Thermometer 40°. A party of people, having in charge a body of about seventy yaks loaded

with *Awa jow,* in sacks, passed our encampment in the direction which we mean to take. March at 8¾. At 2400 paces, many wild asses, and some animals, which are thought more like mules than either horses or asses. At 6780 *Gangri* valley ends. The declivity goes to the left, and the water of this land falls into the *Tírtápurí* river. At 7000, meet the old road. At 12,969, reach our ground opposite to our former encampment.

August 13th.—Thermometer 37°. March at 9^h 15′. At 3970 paces fall into the *Misar* road. At 4460 descend to the bed of a rapid river, which we pass over a *Sankho.* Here we found many *Gelum* families of *Tatar* shepherds, who had been carrying to *Mánsaròwar* the ashes of their deceased relatives. At 5315 paces descend to another river, in rapidity and volume of current similar to the former. As there was here a *Sankho* three feet in breadth, we thought it right to attempt to force our yaks over, loaded; but they disliked going on account of the height of the planks from the water, and the roaring of the river as it descended through the contracted channel. One, which was closely pressed, preferred leaping into the water from a bank of stones seven feet high, and swam under the bridge to the opposite side loaded. At 14,886 paces reach *Tírtápúrí.* Wait in the veranda of the temple, where our wool is packed, until the arrival of our cattle with the baggage, which did not take place till near seven in the evening. Went into the temple to hear the *Gelums* repeat their vespers, the recital of which was accompanied with cymbals, and the beating of a deep-toned drum. The performance of the ceremony was preceded by the blowing of conchs from the top of the temple. We generally found the *Gelums* assisted by the *Juárís* or *Dhármís.*—One of these men said that the breach of chastity in a nun was compensated by a fine of fifty rupees, and that of a monk or *Gelum* by one of sixty.

August 14th—Halt at *Tírtápúrí.* Thermometer 38°.

A report is current amongst the *Juáris* and *Dhármis*, that the *Gorkháli* governor of *Srínagar* has written that he understands two *Europeans* have gone by the *Níti*, and two others by the *Dhárma* pass, into the *Undés*. He desires information may be conveyed to him, as to who they are and with what intention they are going.

Some *Juárís*, whom we here met, were concerned in the transaction respecting conveying shawl wool to *Belebré* fair for Mr. GILLMAN, which had excited the attention of the *Latákhis*, caused their complaint to the *Garpan*, and his severe edict against the clandestine sale of this article. One man told me, that he had been seized by AHMED KHAN the *Latákhi*, for having a small quantity in his possession, which he said he was about to make into *pankhís*.—This day I was much indisposed with fever.

August 15th.—Thermometer 44°. March at 9^h 30′: at 4700 paces come to an ascent of high Table Land. At 5836, a large river, supposed to issue from *Ráwan-hrad*, joins the *Térat* river, at S. 30 E. distant $1\frac{1}{4}$ mile, the little stream falls into it here likewise. The stream resulting from this junction now takes the name of the *Satudrá*. At 6325 arrive at some mud temples with many caves in the rocks, shewing the place to have been once a winter resort of the *U'niyas*, but now deserted. A violent storm of wind, thunder, lightning, hail, and rain, now sets in and lasts till nearly an hour.—Rains again at sun-set. Thermometer 59°. Find two *Juárís* encamped here on the road to *Kien-lung*: one of these traders reproached us with spoiling their market, by selling our goods at too low a rate. The *Juárís* have hitherto been the principal medium through which the *U'niyas* have received, since the conquest of the hills by the *Gorkhális*, the produce of *Hindústan* and *European* merchandise; and they have sold their wares at so high a rate, as to have confined the demand to a few rich individuals, such as the *Garpan*, *Débas*, and *Nerbas*.

August 16th.—Thermometer 45°. March at 8^h 30′. River remaining close to the left. The low warm swampy land in the vales about *Tírtápúrí* gives a grass, which is cut and carried as hay for winter provision, for the horses of the *Garpan*, and the people of *Kien lung*, *Dábá* and *Dúmpú*. The grain called *Awa-jau* raised in *Tíkla-kote* is also given to them during the rigorous season, and said to be hearty food. As this grain grows in a rigorous climate, it is worth while to send some to *Britain* for the use of the inhabitants of the western isles.

At 5280 paces, reach a steep rocky pass of a stone laminated, rolled and whirled as at *Tirtápúrí*, and apparently bound by the same agency. At 5600, broken ground presents appearances similar to those in which gold dust is found. At 5740, immense masses of broken rock of a brown colour, much veined with quartz, in the cavities of which is much rock crystal; that, which is small, generally transparent and regular in form; the large crystals ordinarily discoloured, full of flaws, and fractured or shivered. At 6737, water drips over an inclined plain of rock and tastes salt and nauseous. At 7178, hot-water flows from the rock and covers the edges of its course with stony concretion of a yellowish colour. At 9465, reach a good *sankho* over the *Setlej* about fifteen paces long, and four feet broad. On the right bank a natural fountain throws hot water a foot above its level, the edges of which are covered with a compact, hard, white, tufa, at a distance looking like ice. Come to our ground at 4^h 10′: wait in a cave till our baggage arrives. Have this day come 9765 paces, and encamp in a hollow surrounded by rocks formed by hot-water, opposite to the town of *Kien-lung*, situated on spires of rock on the right bank of the *Setlej* distant $\frac{3}{4}$ of a mile. The road of to-day has been of a very rugged description: and the yaks with the wool and baggage were obliged to make a circuitous route over the tops of the hills, in order to prevent the loads being knocked off by the stones which projected from the sides of the path that we took. Yet,

notwithstanding, many of the loads fell, and at night it was discovered that the sirkar's bundle was missing, along with a small packet of *Cashmír* saffron which I had bought from the *Latákhí* agent.

The whole of the country, from *Tírtápúrí* to *Kien-lung* or *Chinglung*, exhibits abundant proof of the presence of minerals, and the rocks teem with springs of hot-water, impregnated with various mineral and saline substances, which we had neither leisure nor means to analyze: the springs of *Tírtápúrí* seem charged with calcareous matter alone, which in process of time becomes lime-stone, marble, and calcareous spar. Near *Kien-lung*, the hot-water contains calcareous matter mixed with salts. Still nearer to this town, it is charged with iron; and opposite to *Kien-lung* is a cavern into which drips water highly charged with sulphuric acid. This cavern is about twelve feet in breadth, at its mouth five feet high, and about fourteen feet in depth, from the entrance to the back part. The floor consists of projections of calcareous matter mixed with sulphur, and cavities or pools of water about four feet deep, transparent, highly charged with sulphur. Hot sulphureous vapour issues through numerous holes in the floor, and a person is thrown into perspiration almost immediately, without his breathing being incommoded, by the sulphur steam, provided he stand upright: but he is seized with coughing and a sense of suffocation, if he crouch on the floor, as happened to a *Hindu* who sat down. This occurs likewise in the grotto *dei cani*, and arises merely from the specific gravity of the sulphureous gas being greater than that of the atmospheric air, with which it does not mix with celerity. The sides of the cavern were formed by calcareous matter, and flour of sulphur, in some places straw colour, in others of a deep brimstone hue. The proportion of brimstone to the other material is nearly two to one. The side is so soft, that it may be scooped off by the hand, and is a little moist. It is rubbed into powder with ease, and

then mixed with oil which unites with the sulphur, and the calcareous matter subsides. Coal has not yet been found by the natives; and fuel is only afforded by the furze in small quantity. If fuel were plentiful, I apprehend, that many hundreds of tons of sulphur might be obtained from this cavern and the immediately surrounding calcareous rock; which, even where white, is highly charged with sulphur. Immediately in front of the mouth of the cavern, and forming as it were its threshold, is a mound of calcareous stone, through chinks of which spring many jets of hot-water perfectly transparent, and of a smell and taste very similar to that of *Harrowgate*. The vast walls and masses of rock, which have been formed by the action of hot springs in this neighbourhood, shew an antiquity that baffles research and would afford food for sceptics.

The town of *Kien-lung*, consisting of about a hundred small houses, built of unburnt bricks painted grey and red, is situated upon the summit of a cluster of spires or natural pillars of indurated clay in the face of high banks of the same material, which overtop it by at least a hundred feet; whilst the town itself is at least 200 feet above the bed of the river, and in a retiring angle. This kind of situation seems particularly affected by the *Unias* for their winter retirements; and the preference is founded upon judicious principles; for, from the conical shape of the pinnacles which form the foundation of the houses, the snow slips from them and falls into the valley below; the height of the rocks behind guards them from the force of the winds which sweep over the summits of the hills, and the elevation of the town above the level of the plain prevents the inhabitants from feeling the blasts which frequently rush along the course of the river with a violence which can scarcely be conceived.—At present, from this being the season most favourable for pasturage, the greatest part of the inhabitants have left the town and gone to a distance with their flocks and herds.

August 17th.—Thermometer 42°. Four men were dispatched before day-break in search of the sirkar's bundle, which they found, and returned by nine o'clock; however, as the servants had begun to cook their victuals, we could not march till 1^h 50′. The heat was very great.—At 500 paces a strong sulphureous smell issues from hot springs; the rocks stained yellow with sulphur, which appears in considerable quantity mixed with earth, in interstices betwixt masses of rock. At 2875, the channel of the river, from being broad, suddenly reduced to 50 yards; road along its edge stony. Reached our ground at seven P. M., 8383 paces. This has been one of the most rugged marches we have had in the *U'ndés*. As it grew dark, we fired carbines occasionally, to apprize our people behind of the direction we were encamped in; and at half past nine had the satisfaction to see them arrive without having met with any serious accident.

August 18th.—Thermometer 37°. March at 8^h 55′. Some of the yak cows left the watercourse and went up the rock, the face of which became steeper as they advanced. One of them, finding herself separated from the great mass of her companions, without hesitation leaped from a height of about fourteen feet into the dry watercourse, apparently without being hurt by the shock; and her example was followed by those which had taken the same path.

At 6900 paces, commence descending to a river formed of two branches, the right coming from S. 5 W. the left S. 35 W. They run N. 30 E. At 7625 reach the point at which the streams just mentioned join, and, breaking through a high mountain, fall into the *Setlej*. The bank on this side is as it were dissected; the softer parts having been washed from the harder strata: the latter present a very irregular and extraordinary projecting surface. At 7700, cross the river 1½ feet deep; at 8000 descend to the second river, the water of which is more clear, and its

banks afford more grass and furze for fuel. At 8050, cross and encamp at 1h. P. M. Here we observed on the banks of the river many *larva* of a kind of locust, which breeds on the stony plains of *Tatary*, marked on the body with a yellow ring on a black ground, and having a large horn in the tail. Two species of locusts breed here: one with purple wings; by clapping the horny cases strongly together, it makes a smart crack as it flies. The other is twice as large, the carcass and wings of a yellow, spotted with points a little darker.

High wind from the *Himáchal*, which lasted from three to night-fall. Thermometer at seven P. M. 56°.

August 19th.—Slight frost. Thermometer 37°. March at 7h. At 1300 paces, observe that the two rivers which we crossed yesterday join due east about 900 yards. At 5000 commence ascending the gorge, and reach the summit of height which shuts the valley. At 5240, arrive at a pile of stones and descend by a tolerably good road, on which were many small fragments of different coloured jasper and white agate; to the right is the river formed by two streams, and now running parallel to our line of march about 2½ miles distant. At 15,700 commence descending; the town of *Dúmpú* in sight. This is built on a steep eminence forming part of a ridge stretching from the side of a mountain and sloping to a river, but rising at least 300 feet above the bed of the latter. Some ruined buildings on another eminence are separated from the town by a deep glen, in which runs a stream of delicious water. The banks of this watercourse, cut into steps or narrow beds, are now covered by the grain called *Awa jau* now in ear, and watered by cuts from the stream begun near its source. The relief afforded to the eye by dwelling upon this, after having been so long tired with the repetition of bare rocks and of plains most scantily sprinkled with verdure, is such as cannot be conceived except by those who chance to have been in such situa-

tions. The inhabitants have also been equally industrious in turning to account a shelf of gently-sloping land at the foot of the ridge watered by the large river. The regularity and luxuriance of the crop shew, that the soil would be very grateful if the farmer would irrigate sufficiently.

August 20th.—Halt at *Dúmpú*. Thermometer 49°. The warmest day we have had since our arrival on the *U'ndés*. AMER SINGH arrived at ten this morning. It appears that a dawk, or post carried by horses, regularly goes from *Ghertope* to *Ouchong (Lassa.)* Each horse performs twenty kos a day; and the journey takes up twenty-two days at this rate. So that, giving the kos as two miles, the distance may be estimated at 880 miles. The intermediate country is most thinly peopled. The shawl goats are from *Latákh* to *Lassa*, where it is said there are sheep with finer wool than here. The *Ouchong* merchants buy woollen cloth at *Ghertope* from the *Latákhí* and *Juárí* traders.

This day has been hot, with the exception of about half an hour, during which we had a smart shower of hail. Thermometer at night 56°. We were obliged to halt this day, on account of our cattle being much tired, not only from the continued marching that they have had, but from their having seldom been able to fill their bellies on account of the scarcity of grass in the course of our route.

August 21st.—Thermometer 45°. Leave *Dúmpú* at $8^h\ 50'$. At 380 paces cross a small river, the water from which is made use of for irrigating some steps of land sown with *Awa-jau*. At 6514 reach Table Land; a house of unburnt bricks about eighty yards to the left; to the S. four or five others, which constitute the village of *Gengoul*, formerly tolerably populous, but now nearly deserted. It bears S. 60 W. from our encampment at

6740, at which we arrived at two P. M. The furze adjoining the *Awa-jau* fields, with some springy land, formed a favourite resort to hares; and many *Chakórs** were heard in the neighbouring hills; and taking our guns, Mr. H. and myself had good sport. Found a partridge very like that of *England* in plumage and size, but which had a strange grunting call. This bird ran astonishingly swift, and I could not make it take wing. The *Chakórs* breed in the hills, and afforded excellent diversion, although at the same time it was very laborious and not without danger. This day three of our loaded yaks fell over a steep bank from thirty to forty feet high into a ravine; and, although they had struggled much to disentangle themselves, lay on their backs unable to get up; on the ropes being cut, they rose apparently with very little injury. Thermometer at night 55°.

August 22d.—Thermometer 37°. March at 8^h 45′. At 11,900 paces arrive at a pile of stones with religious inscriptions carved upon them. *Dábá* looks larger from hence than from the approach to it on the *Nítí* road. We were welcomed by a crowd of half-naked, dirty, ragged children, in terms of friendship, and they were made happy for the moment by a few scraps of broken biscuit and some raisins. We proceeded to our original encampment in the town, having completed 12,575 paces at 4^h 40′ P. M. We thought it proper to inform the *Wazír* and *Déba* of our arrival, and to inquire where it would be agreeable to them that we should pay them a visit; to this a reply was sent, that they should be glad to see us the following morning.—About half-past eight in the evening, the old *pundit* came to say that the moon was eclipsed, and we immediately heard the sound of trumpets and beating of drums and gongs from the temple of NA'RA'YAN, and that erected on the site of the old palace of the SU'RJABANS RA'JA'. This I presume was in-

* Perdix rufa.

tended to drive away the dragon, which during the time of an eclipse, is supposed by the *Chinese* to attempt to devour the moon. This eclipse was a total one; but the obscurity was much less dense than I ever before observed it. Thermometer at night *55°*.

August 23d.—Halt at *Dábá*, or as pronounced, *Dhápa*. Thermometer 40° at sun-rise. At nine, a messenger from the *Wazír* and *Déba* stated, that they were ready to receive us. In an apartment on the roof of the government house, we found the *Wazír* and *Déba*, along with the brother of the *Garpán*, and a person whom we took for a commander of cavalry, seated in an open verandah, in front of which we placed ourselves on a cushion.—The presents made this time were less costly than those on our first interview with the young *Wazír* and *Déba*. After the usual complimentary inquiries, the *Garpán's* brother remarked, that our journey had taken up a considerable time, and that he feared, if our return to *Hindústan* were much longer delayed, it might be stopped altogether by a sudden fall of snow filling all the passes: a circumstance not unusual at this season of the year. In answer to his remark, it was observed, that we had been somewhat delayed by an illness which attacked me soon after I left *Ghertope*; and that our cattle had been so reduced by continued marching and scanty supply of food, as to be incapable of proceeding as quickly as we wished.—That we were very solicitous to return to our homes, and should depart as soon as our cattle should be a little recruited, and the *Wazír* and *Déba* would assist us by hiring cattle to enable us to carry our wool to *Nítí*. This latter they promised to do without delay. I exchanged a knife with the *Wazír* for a curved horn snuff-box. After a sitting of two hours, during which a plate of raisins was placed before us, we took leave and made a visit to the *Lama*. The old man was apparently much pleased to see us and had tea prepared, of which according to our *Hindu* character we could not partake.

Mr. H. brought as much orange cloth as would make him a dress, but this he refused, saying the weight of the obligation would be too great, it being out of his power to make a suitable return for such civility. I found that a knife and pair of scissors would be acceptable to him, and I sent for them. He was most highly gratified by this token of regard, and gave us some slips of gauze sent to him by the *Déba Lama,* along with some red comfits made of flour, water, and some red colouring matter; they were insipid, but having been made by the holy hands of the head of the church of this country, were said to possess extraordinary virtues, provided they were eaten before any other thing in the morning. These properties lay in a very small space; for the comfits were no bigger than partridge shot. Being desirous of bringing a specimen of the *U'nia* writing, some of which had appeared to me very neat, I requested, that he would give me a written paper, as also one that had been printed. In compliance with my desire he gave me three slips of blue paper, on which some prayers were written in letters of gold by a *Gelum* lately dead; and with his own hand he struck off from a wooden block another prayer on a piece of coarse *Litbarua* paper. In the latter, having placed a few grains of *Awa-jau,* he blessed it, and wrapping it round with an orange-coloured silk thread drawn out of an open stuff with loose ends apparently for this purpose, he recommended us to hang it in a particular direction, and we should find it in some respects useful to us. He caused some tea-leaves in a mass to be brought to us, along with a small piece of soda, which is in this country always employed to extract more of the colouring matter and flavour of the tea than would be done by the water alone which is here hard. A cheese made of meal and milk slightly daubed over with coarse sugar, and having a few raisins stuck in it, with a cake of a sweetmeat made of sugar and butter, and a large plate of raisins, formed his present. The cheese had a very strong smell, and as well as the tea

and sweetmeat was given to our servants. The old man finding, that we would not take back the cloth, requested that it might be given him the following day in the presence of the *Gelums*. The more we have seen of this priest the more we are pleased with the simplicity of his manners and the liberality of his sentiments, as far as the stupidity of our interpreter would give us to understand his conversation.

In the evening we were desired again to visit the *Wazír* and *Déba*. They were engaged in writing to the *Garpan*; and we requested, that a letter, in general terms, informing him of our safe arrival, and expressing our thanks for his attentions, might be transmitted to him in our name; which was done. It was promised, that on the following morning some cattle should be brought, that we might select two for our own riding, at the rate of fifteen rupees nominal per head, and that others would be furnished to carry our wool and baggage. Two trays, containing rice with a lump of butter, secured in a piece of the skin of a yak with the hair on, were put before us as a present, along with a plate of raisins; and a written order, signed by the *Wazír* and *Déba*, for five goats, was directed to be given to the steward, who would on receiving it immediately forward the animals. Thermometer 55° in the evening. At night the *Wazír* sent an agate snuff-box, in exchange for that of horn. After I had the latter in my possession, I observed a small ring of gold, by means of which the bottom was capable of being taken out in order that the snuff may be put in, the mouth being too small for this purpose. I could not help thinking, that the *Wazír* had overlooked this circumstance in the first instance, and now recollecting it, thought he had made a bad bargain. Under this impression, and resolving to defeat his avarice in this matter, I pretended to misunderstand his message, and returned another knife with a small silver-capped glass salt muffineer that had been admired in the morning by him. The

agate box was in the shape of an urn flattened at the sides, and surmounted at each shoulder by the mask of a satyr. This appears to me an antique of *Grecian* workmanship; or, if it should be of *Tatar* fabric, the hollowing does credit to their ingenuity. The *Wazír* seemed pleased with his new bargain.

August 24th.—Thermometer 39°. This morning we went to the lodging of a *Latákhí-Cashmírian* merchant, who shewed us *Russian* leather and *French* woollen cloth. The *Latákhí* said, that the *Russians* had latterly imported much merchandise into this part of *Tatary* through *Yarkund*, which is forty days' journey from *Latákh* and fifteen from *Bokhara.*

At night the *Wazír* and the rest of his council sent for the old pandit, and the brother of the *Garpán* said, that they were anxious for our departure, lest some accident might occur to us, which would be a source of great uneasiness to them. That we had now passed through their country once; and as we were *Firinghis*, we could not be allowed to come a second time. The pandit said, that they well knew he was conscious that they had it not in their power to prevent our visiting the country whenever we pleased. That whether we should do so or not depended upon the orders of our superiors; but, if we should, our dealings would always be governed by the same integrity which they had already witnessed, and which they could not but approve. He then departed. This day a well looking *Juarí* in a clean dress, of the name of DEB or DEBA SINGH, came to pay his respects to us; he was son to a man of consequence of the name of DHAMU', who had ordered him to come over, and, whether we were *Mahants* or not, to offer his services in whatever we thought he might be useful. If he thought us not *Mahants*, he was directed to say that 2000 men were ready to take arms for the cause of the *Rájá* whenever a rallying point was furnished. He said,

that, as our journey had been long, and we had, he understood, been made to incur unnecessary expense, he should be happy to furnish a draft on *Srinagar* for a thousand rupees, if it would afford us any accommodation, and would take the amount at *Haridwar*, either in goods or money, as might be most agreeable to us. We thanked him for the offer; which we declined, but employed him in some little offices in which he was serviceable. I sold the whole of the coral beads I had provided, for ninety rupees, to AMR SINGH, who passed them over to DE'B SINGH for fifty shawl-wool goats and twenty sheep, to be delivered to him at *Níti*, and to be brought down to *Chilkia* by HARKH DE'B. This, though much under their value, was the best return I could form, as, in the event of accident to our first batch of goats, the second might fill their place; and this precaution was the more necessary, as all the persons we met with, said, that by far the greater part of these animals, if taken through the hills before the cold weather should have set in, would die on the march.

August 25th.—Thermometer 41°. The *Wazír* and *Déba* sent word, that the yaks would be ready to take our loads this morning; we returned an answer, that we should not be able to march until the following morning: and that this would depend upon their performing their contract. A messenger returned with twelve rupees from the *Wazír* and *Déba*, instead of a like number of goats which they had undertaken to supply, but now said they could not furnish; and this was soon followed by those persons who said that the people from *Ghertope* were extremely anxious to return, and expected we would set off this morning, as they could not depart until we had began our march. We repeated our arguments and ordered our cattle out of the town to graze. An order was given by the *Wazír*, &c. to shut the gates, and we sent two resolute men to open it, and to turn out the yaks. This they effected without resistance.—We then remon-

strated in very strong terms with the *Wazír* and *Déba* on the impropriety, and meanness of their conduct; after a little conversation they both appeared ashamed, and said they did not act from themselves, but under the authority of the *Ghertope* messengers by order from the *Garpán*. Immediately after the *Wazír* and *Déba* returned, these people learnt our intention, and without waiting for our visit, saddled their horses and went off. The *Wazír* and *Déba*, sent word privately, that, if we would take saffron, they would in the evening take some of our cloth. The *Latákhí* saffron is received by the *Latákhís* from the *Cashmírian* traders, in payment for the shawl wool furnished by the latter; and again given to the *U'nias* in payment for the wool taken from them. It appears to me pure, but dear; however, the highness of price is, in some measure, owing to the form of the transaction being by barter. According to our promise we went to the government house, where we were received with a cordiality calculated to efface the impression of the late transactions, and which our conduct on the occasion shewed had produced that effect. The *Wazír* and *Déba* said, that really there was much danger of our entering *Hindústan* being prevented altogether, if our departure were delayed; that if they followed their own inclination, they could wish us to stay longer; but the season was advanced, and it would much grieve both the *Garpán* and themselves if any accident were to occur to us.

August 26th.—Thermometer 37°. We commenced our march from *Dábá* at ten A. M., following the direction by which we arrived at first, in which line we continued, and crossing the *Tiltil* reached the junction of the two streams before mentioned at twelve, having come only about three miles. Here the measurement commenced as we took a new road. At 2^h 30′ took up our ground for encampment. Our baggage did not reach us till eight at night, in consequence of many of the loads falling off,

from the ruggedness of part of the road, and from our people having kept in the direction of the former line instead of following us exactly. The road we have now taken is in the straight line for *Niti*, the other was circuitous, but better. DE'B SINGH came in the evening, and promised to send us three fat sheep for our consumption on the road. When the sun set it became very cold; before sun-set thermometer 48°.

August 27th.—As our cattle had been much reduced by their long journey from *Ghertope* to *Mánsaröwar* and back to *Déba*, they had performed their work of yesterday but weakly, and it was therefore judged advisable to halt, that they might have a chance of filling their bellies, although the pasturage was even here but scanty. DE'B SINGH was very anxious to receive a certificate of his endeavours to be useful, and a recommendation that he should be permitted to enter the Company's provinces paying only the usual duties. The papers required by DE'B SINGH were given to him, and he took his leave highly satisfied in appearance. Much ice in the river this morning.

August 28th.—Hard frost. In some places the ice was $2\frac{1}{2}$ inches thick. Thermometer 28°. Marched at 9. At 7300 paces reach our ground, and encamp at 12^h $30'$. Thermometer in the open air 67°. Found many ammonites in iron-stone, generally broken. Much iron in the mountains, which have scarcely any vegetable upon them, and are rapidly frittering into fragments. We are now about one third of the *Gháti* which separates *Hindústan* from *Tatary*. Mountains are less high and bold than those farther on in *Bútán*. Two yaks have been left behind from fatigue, although the march has not been long, yet parts have been very distressing. The rivulet or rather river (for when it fills its channel it well deserves this name,) is called *Chang-lu*. It is formed by three or four branches, which issue from the heights below

the *Níti Gháti*, and it disembogues itself into the *Setlej*.

August 29th.—Thermometer 29°. Hard frost; and very cold to our feelings. Leave our ground at ten A. M. At 3745 paces reach the bed of the river near which we halted on the first day, after crossing the *Gháti*, in our road to *Dábá*. The name of this is *Jandú*. It rises N. 85 W., and runs N. 80 E. to the *Setlej*. The banks are formed by stupendously lofty mountains. At 6125 reach the *Gháti*, which separates *Bútan* from the *U'ndés*, and which has upon it a large pile of stones, the offering of travellers, surmounted by rags in token of the victory they achieved in reaching so great a height. The *Gháti* is about half a mile broad, almost without any vegetable. The wind from the *Bútan* mountains covered with snow is most piercingly cold. We turned out of the road, to the left hand, and, in order to save a little distance, scaled an ascent which cost us double in time. One of the yaks, which had fallen from a precipice a few days before, and received such a shock as rendered him unfit for carrying a load, after he had ascended a few steps, suddenly returned, and ran downwards towards the river as rapidly as the badness of the road would admit, and faster than any one who has never seen these animals travel over crags would suppose possible. I had got upon a *Jabú* (or mule between a yak and a cow), and was bringing up the rear. The animal charged me, and endeavoured to overthrow my steed, who however stood firm. Luckily he took my thigh between his horns, and did not hurt me materially. When he found room, he did not repeat the attack, but continued his course towards the river, upon the bank of which he stood still. I leaped off the *Jabú*, had him secured, and passed a cord through a hole in his nose. Though one of the most tractable animals I had ever seen, before the fall, he now was become wholly the reverse: I saw, that some derangement of the brain had taken place, and was obliged to

abandon him. Another yak, the best of my herd, actually separated the hoofs from the toes of the hind feet in exertions to climb the stones; and after bleeding very largely and prosecuting his journey in great pain, when a stop was made to allow of the others taking breath, he also refused to proceed. The *U'nías*, who had brought the wool on hire, on the *Wazir* and *Déba's* cattle, sat down every five or six steps on stones, and smoked and spun yarn till the animals were disposed to proceed. This was a terrible day. The descent was very slippery as well as steep, and required great precaution. The ascent of the *Gáhtí* measured 2110 paces, the descent 1750. At 9835 reach a good grassy plain on the left bank of the rivulet, which runs from the *Ghátí* to the south, in order to fall into the *Daulí* and encamp at 5^h 50′. The goats reaching the bottom of the *Ghátí* first, instead of taking the right road, by the carelessness of the people in charge, went up a crag about 500 feet above the level of the road, and very leisurely placed themselves on the very edge of the precipice; a mountaineer, native of *Kamáún* followed them, and by throwing stones and calling, at length succeeded in dislodging them from the dangerous post they had taken. The latter rank, in coming down, deranged loose stones which tumbled down an abrupt slope, by which they descended with a force that threatened to overthrow those which were nearest the bottom; and it really was entertaining to see with what address, whilst at a run, they avoided the blows of the rolling stones without turning their heads in the direction of their descent. In this march we met with much wild *Chaná**, not yet ripe. This might be an acquisition to the mountains of *Scotland* and *Wales*. Thermometer at night 39°, wind high.

August 30th.—Snow falling on the adjacent mountains, and in less quantity on our tents; thermometer 37°.

* Cicer arietinum?

Had we not crossed the *Gháti* yesterday, we should have found it difficult to-day. As the pasturage here was good, and it is a long time since our cattle have fairly filled their bellies, we halted this day. In the course of the morning the *U'nias* in charge of the *Wazír's* sheep came up, and stated that they could not bring up our cattle: that at the foot of the dry watercourse being unwilling to move, and the other very lame. Thermometer at night 41°.

August 31st.—Thermometer 41°. Water frozen during the night. Frost greatest just before sun-rise. March at eight A. M. At 1280 paces arrive at the bed of the *Daulí* river. The stream is now much broader and deeper than when we crossed before. The rivulet, near which we encamped last night, falls into the *Daulí* here, which is about two feet deep and very rapid. The descent was very rugged, and winding amidst large blocks of stone: much of the *Chaná* on both the banks of the river; the grains smaller than that cultivated; but the plant throws out many pods, much foliage, and appears hardy.—At 3700 paces reach the ground on which we encamped in going; and, finding our cattle much fatigued from the badness of the road, abandon our intention of endeavouring to reach *Gótang*. When we went to the *U'ndés*, the mountains, by which we are now surrounded, were almost entirely bare; they are now covered with verdure; and many of the plants going to seed. The white, yellow, and red flowering strawberry have bore abundance of flowers, but only a cone of seed without any pulp. Whether in a more kindly soil, they would produce fruit may be worth trying.

September 1st.—Thermometer 36°. March at eight by the same route we came. Descend the steep *Gháti* to the bed of the *Daulí*. One of the yaks could not be driven round the projection of rock which led to it, but resolutely charged back again in spite of sticks and stones.

The *U'nías* went by a lower road along the steep face of the rock. The stream of the *Daulí* was very rapid and reached half way up the yak's shoulder. After having gone about a hundred yards, perpendicular rocks, dipping into the river, compelled them to cross again to the right bank, and a third crossing took place immediately above the *Sanga*, which was so bad that our men were afraid of going along it even with very light loads. Their apprehensions were reasonable enough, for the *Sanga* was made only of two loose sticks of fir, with large loose stones sloped nearly in the angle of 45°. At 6100 paces, the *Daulí* meets the stream which comes from behind the *Nar-Náráyan Parbat* near *Bhadrínát'h*. This river is larger than the *Daulí*. Of the two arches of snow, which lay over the river as we passed before, one had dissolved, and nothing remained but the abutments; the other was entire and still of great thickness. The road was almost as bad as possible. Indeed it is scarcely in the power of imagination to suppose, that such a surface could be trodden by men and cattle, without their being precipitated into the *Daulí*, which rolled a tremendous current at the foot of the slope, over which the path run (if that could be with any propriety called such a name, when effaced in many places by recent slips, and in others by blocks of stones, for nearly a quarter of a mile together.) This was a march of disaster. The yaks, in inclining their bodies towards the mountain to prevent their slipping into the river, struck their loads against portions of rock, and tore the packages. At every hundred yards, there was a cry of something being wrong. The people anxious to get over the dangers and difficulties of the march, in opposition to what I could say, persisted in driving the cattle too fast. The day was very hot; and the yaks, oppressed by the heat, the weight of their burthens, and the incessant calling and flinging of stones, found no more effectual way of escaping from these annoyances, than by running down the almost perpendicular face of the rock and dashing into the cold

stream. Sometimes by the slipping of the soil they fell into the water with some violence, and after cooling themselves, to my great mortification, generally lost their loads in climbing over stones to regain the road. At 3, reached our ground; and in the evening, I had the mortification to learn, that two yaks in the last detachment could not be brought forward. One had slipped into a niche in the bank of the river and could not get up; and the other had become so very lame, as to be unable to pass over the sharp edged blocks of stone which lay in the road. At night thermometer 56°.

September 2d.—Halt at *Gótang*. Thermometer 56°. At night, 54°.

September 3d.—Thermometer 44°. March at 10, A. M. The sight of trees is extremely pleasing after our being so long absent from them. The rhubarb had now run to seed. I cut up many roots, but found the whole more or less spongy and rotten. From the holes I have seen in the *Turkey* rhubarb, and its irregular knobby form I apprehend that this is its usual habit. Gentian is met with in great abundance, is called here *Catcí*, and given in infusion to goats and sheep; most especially, when, in travelling towards *Hindústan*, they are supposed to be distressed by heat. The woods here are composed of birch, the great *Rhododendron**, willow†, and mountain-ash with brown berries. The road was extremely bad; and the trouble we had from the falling off of the loads, and from our yak cows and calves straying up the mountains, and down the sides of stupendous precipices, where it was scarcely possible for them to fix one claw, is not to be conceived. It was nearly night when I reached *Nìtí*, notwithstanding Amr Singh brought several yaks to assist us. The lame yak was brought to *Gotáng*, and there left to recruit in the

* Rhododendron puniceum. *Rox.*
† Salix tetrasperma. *Rox.*

abundant pasture of that place; that, which had fallen into a nook of rock near the river, could not be found. The upper part of *Bútán* is now suffering much from scarcity of grain, in consequence of the *Júarís* and *Dharmís* plundering the *Gangárís*, or people living on the banks of the *Ganges* within the hills, who were in the habit of bringing up the grain they raised, and that which they procured from below.

September 4th.—Thermometer 54° in the morning; 80° at noon. In the afternoon there was a fall of rain, accompanied by thunder. At night thermometer 54°. The gooseberry-bushes, which were in flower when we were here before, are now full of fruit, of which only a few are ripe. They are, as I conjectured, of the burgundy kind, but small; and the pulp is much smaller than that of *England* in proportion to the bulk of the seed; but this may be remedied by cultivation. Of currants I found two varieties, one orange-coloured with small fruit in small clusters, the other of a dark purple or rather nearly black in large bunches from a tree, with bark like that of the black currant in *England*, but with the flavour of the red one, only more acid. This morning we sent to announce to the *Séyánas* that we had arrived, were anxious to depart, and were in want of provisions. In the evening ARJUN and GU'JAR came, and said that the terms of carrying the baggage should be adjusted to-morrow.

September 5th.—Thermometer 48°. At night 62°.

September 6th.—Morning cloudy with small rain; thermometer 52°. At night 54°.

September 7th.—A party of *Gorkhalí Sipahís*, consisting of a havildar and four privates, arrived to-day for money due from the *Nítías* to their company under the command of BHACTI THA'PA'. The havildar

brought a letter from BHAWA'NÍ SINGH, ordering the *Nítí* people to render every assistance in their power to us; and that, if they should not do so he would levy a heavy fine upon them. The havildar came to pay his respects to us, and said, that he had received directions to pay every attention to us in his power, and that he should immediately procure carriers. We gave him five rupees in *Timashas*, as an earnest of what he might expect if he exerted himself. He promised, that we should start to-morrow. In about an hour he returned with three other *Sipáhís*, and twenty rupees were tendered to him as subsistence money to the carriers. He refused this at first, saying that our effects were to be conveyed free of expense to *Jóshí Math*. This we declined, saying it was improper for people coming on objects of *Dharm* (piety), to have baggage carried without hire; and he took the money.

September 8th.—At 12^h 30′ we began our march. At 3200 paces reach *Gamsáli*, whence the people took up our loads immediately. At 3315 cross the *Sankha* of the rivulet from the right, now much swollen. At 4182 reach *Bampa*. Here the loads were again carried on towards *Pharkia*; and at 4886 paces encamp to the north of our former ground near the village, at 4^h 55′. Wind high and some rain. The crops of *Pháphar*, buck wheat, are very good. These with the *Awa-jou* are nearly ripe. Barberries are affording a second crop. The *Shíkarí*, who received from us two rupees on the banks of the *Chang-lú* for killing a *Baral*, was engaged at *Gamsalí* watching the crops, and said he was debarred using his gun by the *Seyánas* until the crops were got in, as snow would certainly follow the explosion. We respected their prejudices, and did not go out, although the black partridge tempted us to do so, in pursuit of them, by their frequent calls.

September 9th.—Thermometer 50°. Marched at 11.

The villagers of *Pharkiah* made much hesitation in taking up our loads, notwithstanding the *Gorkhalí* havildar threatened them with a fine, and offered a deduction of two rupees from their payment of revenue. At length they agreed, and a party set off. At 4900 paces cross the *Sankha* over the *Daulí*, at the place where a wall is built with a door in it for the purpose of preventing the goats and sheep laden with salt and wool, coming from the *U'ndés* or northermost part of *Bután*, springing into the river. Whilst taking a little rest upon a stone, I heard the call of *Chakórs* on some rocks of great height, to which I gained access by a steep, long, and difficult route. Whilst clambering up, I had very nearly placed my hands upon a brown snake which had got half its body into a hole, before I was able to strike it. I succeeded in getting three *Chakórs*, one of which was of great size, and had large double spurs, one above the other on each leg. At 4^h $35'$ reached *Malárí*, having come 5740 paces. The crops of Millet, *Pháphar*, and *Awa-jou* look well. The bed of ice, which filled the bed of the *Malárí* river, has disappeared, but the tops of the high mountains to the east are covered with snow.

September 10th.—Thermometer 54°. Rained till 11. Halted on account of our loads not having come up yesterday. As far as *Látá* southwards, the country is called *But'hant*, but it is understood that the *Rengní* river separates that country from *Hindústan*. The *Butias* pay a small sum of money annually to the *U'nias*, or its value in kind; and the quota of *Malárí* is six rupees, which is commonly in barley. The inhabitants of the whole tract between *Látá* and *Nítí* complain much of the extortions of the *Gorkiahs*. The poorest man is compelled to pay a poll tax of four *kacha* rupees. This has caused many villages to be deserted; and the population is now much diminished. This evening whilst looking at our goats, a *Malárí* man came to us and entered into conversation. We asked how it hap-

pened that one portion of the village was in ruins, and that so many of the houses were in such a state of decay? The former inhabitants, he said, were dead; and when inquiry was made, if there had been any sudden and violent sickness, he answered, that, of the particular quarter to which we pointed, the tenants had been plundered of their goats by the *Juarís;* that, unable without these animals to carry on their usual traffic of grain and salt with the *Uniás,* they were deprived of the means of paying their rent to the *Gorkiahs,* who took the remainder of their cattle, their cooking utensils, the rings out of the noses of their wives and daughters, and seized their children as slaves. Many persons were actually starved to death, and others fled. Including the regular rent, he said, the inhabitants of *Malárí* had an annual sum of 1000 rupees forced from it, although the first only amounts to 250. "In the time of our *Rájás,*" said the man, "these yards, now empty, were filled with goats; each old inhabitant had one house to place his son in when married, and another for his daughter, who had a portion in cattle. We were then, if not wealthy, at least at our ease, and occupied and happy. At present we are poor and wretched. If we had masters like you once again, these pens might contain the same number of cattle as formerly; but at present, if a man by his industry raises a small stock of goats, a *Juárí* or a *Dharmí* plunderer attacks him and carries them off, and we can get no redress from our present masters, nor are we strong enough to resist or make reprisals." Independently of the direct plunder they obtain without any other caution than putting a number of men under arms, the *Juárís* are interested in destroying the trade of the *Nití Ghátí,* in order that they may have a larger proportion of the profitable traffic with the *U'ndés.* At night, the thermometer was 58°,

September 11.—Thermometer 51°. March at seven by the route we came. At 3575 paces cross a *sankha*

over the *Dauli* to the right bank. The descent from hence is very rapid, and the stream is much broken by vast fragments of rock and heaps of timber which have been much accumulated since our passing upwards. In one place the river has worked its way under a kind of arch formed of these materials. At 6240 paces reach the village of *Jhelim*, now in ruins with the exception of two or three houses. A villager said that some time ago DE'B SINGH, our *Juári* acquaintance, swept the country during the space of two months, and carried off two thousand head of goats, sheep and neat cattle, without receiving any molestation from the *Gorkiahs*, or being compelled to make restitution or any kind of reparation.

September 12.—Halt at *Jhelim*, as our loads did not come last night.

September 13th.—Thermometer 52°. March at seven and half, A. M.; no tidings of the loads. The village of *Jhelim* is situate on the face of a hill considerably higher than the road from *Látá* to *Malári*; descending therefore, we fell into the old route. On the road we were met by a messenger from BHAWA'NÍ SINGH NE'GÍ, with a letter from him, and another from JAGRUP, jamadar of the party now at *Baragaon* and *Jóshi Math*. The former stated, that the *Gorkiahs* had distressed him much on account of having assisted in forwarding our baggage; that his life would have been forfeited had we not returned by this road; but that now he was perfectly at ease, and disposed to do every thing in his power to serve us. JAGRUP said, that he would take care that we should have every facility that he could afford us in our return: BHAWA'NÍ SINGH stated, that we might take the *Páin Khandí*, or *Búdán* road, as might be most agreeable. At 5645 paces cross the *Daulí* over a very bad *Sankho* to the left bank. Here the road, which is very bad, ascends rapidly; in many places, little more than a foot broad; and the projections from above oblige the

passenger to creep under them almost immediately over the bed of the river, which is about 500 yards below. At 7025 paces reach the summit from whence the descent is very difficult and steep: indeed were a person from below to see travellers above, he could not fail of feeling much anxiety for their situation. At 7650 paces reach our former ground and encamp. A *Sankho* had been washed away, and the loss of a long tree, not worth three rupees in this country, endangers the loss of life to every one who attempts this most dangerous route, of which no conception can be formed by description. Let it suffice to say, that the very goats resisted attempting some parts of it for a considerable time; and that we were in more than one place reduced to the necessity of creeping on our hands and knees: yet every one arrived without accident, and the *Jabú* climbed and descended in a manner that created admiration; but in one spot it was thought advisable that he should attempt an almost perpendicular face of rock, rather than be obliged to come down by another so steep that it was a task of great danger for man. By a long detour he reached us over a tract known to our guides only, but the man who had the care of him declared, that this care was superfluous, for that he could come down a surface as steep as was practicable for man. He had been brought to the side of the river, under an idea that he might have crossed; and from the height of the bank where I stood, I thought the attempt attended with little danger; insomuch, that the best swimmer in the party having declined the task, I had resolved upon trying. However, on reaching the bed of the river and passing one stream, I was deterred from the experiment, in consequence of the force and velocity of the current, the extreme coldness of the water, and the danger of being dashed against the stones or stumps of trees.

Although money had been given to the *Séyánas* of *Jhelim* for the hire of the carriers, they had kept the

money, and not furnished a particle of food to the unfortunate people who had to bear the burden and heat of the day. The oppression exercised by the government renders natives equally oppressive in proportion to their power. Thermometer at night 62°.

September 14th.—Thermometer 58°. March at 9^h 25' along the left bank of the *Dauli;* one of my finest goats, heavy with young, and the boldest in the whole herd, fell into the stream and was hurried away by the current. The bridge was about twelve inches broad and formed by a fir-tree, a little flattened on its upper surface, and a round sapling on each side. Whilst the goats crowded at the foot of the *Sankho*, two went on boldly, but when they had reached within a few feet of the opposite side, the pressure of the feet of the goats had pushed forwards one of the side spars, and unluckily that on which a goat was; one end fell down, and the other tilting up, threw the poor animal into the stream. This spot has brought me much disaster; for it was on its bank, within twenty yards of the *Sankho*, that the pandit's slave dashed my watch from my girdle upon the stones. However this accident did not affect me, although seriously inconvenient, one-tenth so much as the loss of one poor goat that cost only a rupee: but this latter had been attained with more difficulty than the watch had cost me. At 8025 paces reached the road running under the village of *Tolma*, which, surrounded by fields of the crimson *marcha*, looks very pretty. The *marcha* is a plant which I mistook in my journey upwards for the *lal-sag* of *Hindústan*, or the *Amaranthus Gángeticus;* and the *Sipáhis*, who had accompanied the party which went in 1808, to survey the *Ganges*, fell into the same error, and used it as a pot-herb. In a short time, those who had eaten much of it were affected with purging and soreness in the inside of the mouth. The natives of the hills, however, employ it without injury whilst it is young, but I neglected to inquire in

what manner it was dressed. I thought we should be able to reach *Látá* this evening, and therefore pushed on. Having arrived at the foot of the mountain (which we ascended on leaving *Látá*) the sky became suddenly clouded, and large drops of rain, with gusts of wind, announced an approaching storm. As the day closed rapidly, I saw it would not be possible to pass over the rugged mountainous road without accident, as much of it lay on the edge of the cliff over the river, and therefore determined to take up my lodging for the night. A small cavity under a ledge of rock just sheltered me from the rain. Having stretched my carpet and blanket on the ground, I went to bed dinnerless; and my companion fared no better. The principal part of our servants remained behind taking such lodging as they could find: but they were much better circumstanced than their masters, as they had their food along with them.

September 15th.—Thermometer 58°. At eight A. M. began our march. The town of *Látá,* consists only of eight or nine houses, and a temple of NANDA *Déba,* at which officiate some priestesses, who do not, according to report, either take a vow, or observe the practice, of chastity, being allowed what intercourse with the other sex they may think proper to take, without restraint. JOWA'HIR SINGH had now a knowledge of our real character, and said that he would fetch the loads from *Malári* as soon as he should have seen his brother. He was anxious to have a goat to sacrifice to the deity of the place in gratitude for our safe return; but I believe that his own appetite had a greater share in inducing him to prefer this request, than any motive of religion. JOWA'HIR says that provisions are very scarce, owing to the visitations of the locusts, with which the country has been plagued for the last two months. For the preceding two days we have seen many locusts directing their flight towards the *U'ndés*, where they breed. Thermometer at night 72°.

September 16th.—Thermometer 64°. March at 8. At 1340 paces we come to a *Sankho* over the river *Renî* which separates *Bútan* from *Hindústan*, and falls into the *Daulí*. At 7542 encamp in the fields belonging to the village of *Dak*. Our dinner consisted of some pumpkin boiled with *dal*, and hunger made the dish palatable.

September 17th.—Thermometer 66°. March at 8 A.M.; rain increases to such a degree as to prevent us enjoying the pleasure of the shade of the horse-chesnut and rhododendron trees under which we pass. In one of the former were monkeys feeding heartily on their fruit, which is relished by few animals. At 1140 paces reach the summit of the ascent; and at 3145 reach a fountain, near which we encamp, on a spot of uncultivated ground surrounded by the *Sarson*, or mustard, in flower.

The *Nishánchí* or colour-bearer of a company belonging to Bhacti' Tha'pa', paid us a visit. Afterwards Bhawa'ni' Singh Ne'gi' made his appearance. He says that our loads shall be brought from *Mallárí* in a short time, and that he will charge the expense as a set-off against our account of 101 rupees advanced to him on his bond. Thermometer at night 64°.

September 18th.—Thermometer 62°. At noon 74°. Night 64°. Many showers of short continuance but smart in the course of the day, with intervals of sun-shine and heat. The jamâdar Jagrup sent some rice and flour last night, and to-day a present of game.

This man was with Sheristha Tha'pa' at *Sirínagar* in 1808, when Mr. H. came with a party to survey; but on account of his disguise did not recognise him. He gave the following account of the transactions which had reached us in a confused manner, whilst in the *U'ndés*.

DASRAT'H, who was formerly in power at *Sirinagar*, but had been displaced, had written information to *Catmandu*, that BHACTI' THA'PA' had allowed two *Europeans* to go through the country in his division into the *U'ndés*. The *Nepalese* government sent BHACTI' a reprimand, on the receipt of which he sent JAGRUP with thirty men to examine into the foundation of the reports propagated by DASRAT'H, with whom he had long been at enmity. On JAGRUP reaching *Baragaon*, he found that BHAWA'NI' SINGH had left his house to avoid the oppression of a party of DASRAT'H's men, which to the amount of ninety had taken possession of his premises, broken open his granaries, and used the grain they had found in them. He had armed all his dependents: but on JAGRUP sending him assurances of his personal safety, he went over to him. BHAWA'NI' then made a declaration of his ignorance of our being *Europeans*, and of his having received the sum of eighty-seven rupees to forward our baggage to *Nití*. DASRAT'H, in his letter to BHACTI', accused BHAWA'NI' SINGH of having taken three thousand rupees, and made use of this falsehood, as a plea to ruin BHAWA'NI' by extorting that sum from him. The report forwarded to *Catmandu* stated, that we had gone with an intention of building two forts, one at *Nití* and one in the *U'ndés*, to garrison them with *Marchas*, and thence proceed by *Bubesin* to join the *Sikhs*, with whose arms we proposed to invade the country. The accounts amongst the country people were ridiculous enough. One reported that a letter had arrived from *Delhi*, stating that we had stolen the philosopher's stone, and three lacks of rupees from the Company's wife.

A letter arrived from BANDHU THA'PA''S son, now at *Solúr*, directing JAGRUP to treat us with attention, and to take care that no part of our property should receive any injury. He was anxious, that we should march to-morrow to *Solúr*, which is five kos below *Jóshí-math*.

To this the rainy state of the weather was objected : but it was promised that we would go as soon as the weather became fair. The motive he assigned for our going thither was, that we should be able to get provisions easily, which could not be done at *Baragaon*.

September 19th.—Thermometer 59°. During the night, the summits of the neighbouring mountains have been covered with a fall of snow. Halt at *Baragaon*. About 2 P. M. it began to rain smartly and continued without intermission until 6, leaving the air cold and disagreeably damp. After sun-set thermometer 16°.

September 20th.—Thermometer 57°. The jamâdár having strongly represented that they could not procure provisions without the greatest difficulty at *Baragaon*, but that they should be able to get abundance at *Solúr*, we agreed to march as far as *Jóshí-math* to-day, provided it did not rain. At 11ʰ 15′ we marched. At 1300 paces cross a watercourse from which the air before us was filled with an immense body of locusts, some of which were of a light yellow; but the greater number of an orange colour. On heaps of weeds that were dry, and on stones, they assembled by forties and fifties, and remained quiet in the sun-shine; but others were actively employed in eating the heads of *Mandua** now nearly ripe. They had been here about two months, but had not done as much mischief as I should have supposed. A leopard made frequent visits to this neighbourhood, had taken away three children, and killed two men; but the place to which he resorted with his prey was unknown. At the same place where we encamped before, we now pitched our tents, close to a temple. Every other spot for a great extent was occupied by crops of rice, *Marcha*, *Mandua*, and *Sawah*†. The people of

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* Eleusine Coracana.

† Panicum Colonum.

the neighbourhood said, that the leopard would certainly make an attack upon our goats in the night; and we took precautions accordingly by setting a strong watch with loaded guns, and keeping up a good fire.

September 21st.—Thermometer 55°. The leopard has committed some ravage in a village to the East of *Jóshí-math*. In this village my goats were yesterday entangled, and with no small trouble and loss of time I extricated them out of the filthy and intricate roads. Goats are cleanly animals: when they reached one filthy spot, the leading animals stopped, and the whole flock was delayed in a narrow path overhung with long grass, and from which issued a streak drawn upwards by the heat of the sun, that was scarcely supportable by man, and must have been greatly annoying to the animals shut up in an alley of this offensive vapour. At length they clambered up some large blocks of stones.

Our march did not take place till $2^h\ 15'$, owing to the *Gorkha* party having served themselves with carriers for their loads, before they gave any to us. On reaching the foot of the hill, half way up which are many detached cottages, which form the village of *Solúr*, I found my flock, which had started at an early hour. We went up, and after an ascent of about a mile through narrow paths and fields of *Marcha*, *Sawa*, and *Sarson*, reached the residence of BHAWA'NI' SINGH, at the close of day, where was a stone threshing-floor almost covered with hemp, on which we pitched our tents. Gave the body of a goat which died, to the *Gorkia Sipáhís*, who requested to have it for their night's repast.

September 22d.—Halt. BHAWA'NI' SINGH has not come here according to his promise. We found BANDHU THA'PA''s son, the nephew of the general, BHACTI', sick of an intermittent.

September 23d.—After breakfast we set off accompanied by a farmer, who said that he thought it likely we should find wild hogs, bears, deer, and pheasants, if we would go up to the top of a high wooded mountain to the left, which formed part of the great *Túgasí* range. We ascended a steep ridge and passed through a forest of fir, cedar, and cypress,* with sycamore, horse-chesnut, walnut and yew trees, the latter are called *Túnér*. The cedars were of enormous size; one measured 18 cubits in girth at 4 feet from the ground, and was about 180 feet high; another that had fallen down was 159 feet in length: and trees of this size were not uncommon. From this eminence I had a fine prospect, in which a cascade forming the source of the *Patál-Gangá*, that ran in the bottom between two ranges of hills, formed the most prominent feature. This cascade appeared to have a fall of from 80 to 100 feet and was about 20 feet broad. It had almost escaped me to remark, that in our return we met with very large Service trees, bearing fruit much larger than those of this tree in England. I stopped to examine some plants of hemp sown near a house; many of these were twelve feet in height, and few lower than ten; where thinly sown, the plants had very thick stems and sent out many side branches; but when numerous, they were thin, tall and without branches. The person, who sowed them, said, that when the plant was supposed sufficiently ripe for pulling, which is considered to be the case when it is in flower, it is placed on the roof of the house, and exposed to the sun till thoroughly dry; when the bark is stripped off and tied in bundles for use. During the time it is on the house, care is taken to prevent its being wetted, as wet is supposed to weaken the fibres. In stripping, one half of the bark is separated from the wood, by the nails of the finger and thumb of one hand, whilst the finger and thumb of the other are placed, one upon and the other under the bark, during the

* Pine?

the time that it is drawn from the butt towards the point of the stem: this process is performed on the other side, and the bark by the two operations is completely taken off. From what I have seen of the growth of hemp in this country, I have no hesitation in saying, that its luxuriance is such, when sown upon the lands of valleys in *Garwhál* and *Päïn-khan″dí*, as to be capable of supplying a great portion of the navy of *Great Britain*, if its value in *England* will cover the freight and other expenses.

September 24th.—The NE′GI′'s mother last night informed us that JAWA′HIR SINGH had absconded as well as BHAWA′NI′ SINGH, in order to avoid the oppression of the *Gorkiahs*. She gave an afflicting statement of the grievances inflicted by them; assured us, that our loads should be forwarded, and that BHAWA′NI′ SINGH would not be faithless to his engagements: but that we should not see him, as both he and JAWA′HIR feared to be seized and sent to *Sirinagar*. She was very anxious to impress us with a belief, that the warmest wishes of the whole of her family were with us. We then desired BANDHU THA′PA'S son and the jamâdár would come to our tent, and remonstrated with them on our situation. BANDHU THA′PA'S son and an old man his governor expressed their concern at the delay in our journey, and said they were ready to accompany us to *Pálí*, where we should see BANDHU THA′PA′, and that we might rely upon it our effects should reach *Páli* within three days after our arrival. We were obliged to remain satisfied with this explanation, but said, that if we had not an account of the baggage being on the road to us in three days, we would certainly march.

September 25.—As a person acquainted with the management of goats and the culture of the mountain rice would be useful in going to *Calcutta* with the former, and perhaps eventually to *England*, I gave the sum of thirty rupees for a slave offered to me by JAWA′HIR

SINGH, who was apprehensive that he would be forcibly taken from him by the *Gorkhas* if he did not dispose of him.

September 26th.—The jamâdár JAG-RU'P came to take leave. As I saw he expected a present, I filled a *China* box with five rupees in *Timáshís* and gave it to him. He appeared highly gratified with this, and we saw no more of him.

At 9^h $15'$ left the village of *Solúr*. At 8380 paces reach *Panki-math*. The latter part of this journey was very embarrassing, as the rain now was continued and heavy. The path was covered with a glaced surface, so slippery, that few of the party escaped without one or more falls. When quite dark I reached the *Garúl Gangá*, whose current dashed along with great impetuosity. Having safely reached the bank, we were involved in the deepest darkness, and could only ascertain that we were at the foot of a steep hill. Here we were obliged to wait about three quarters of an hour, till a light was brought which shewed a steep narrow path much obstructed by stones and long grass. With much trouble we collected the goats and forced them into the path; but they frequently stopped. Not being able to get them on after a stop of unusual length, I endeavoured to pass through them, and when I got to the foremost rank, felt myself suddenly slip through the grass over a steep ledge, which came along the edge of the path, and down the face of a bank or precipice; for the darkness prevented me from judging of the extent of the danger. A tuft of grass, after I had a short fall, came between my legs, and in a few seconds more I found myself seated upon a stone as if upon a saddle, my feet not touching the ground. By dint of groping about, I found some stout tufts of grass a little above me and well within my reach. These proved firm and enabled me, by there being a succession of them, and by placing my toes

against the face of the bank, to raise my head to the level of the path in the grass; and the hand of a servant drew me up.

September 27th.—Thermometer 60°. This is a deserted village called *Panki-Math*, situated on the top of a hill, but surrounded, except towards the river, by an amphitheatre of others still higher. BANDHU THA'PA's son's party had turned out the inhabitants of a village on the opposite side of the *Garúl Gangá*, and taken refuge from the rain of last night in their houses. I thought it right to halt. Thermometer 67°. At four P. M. the son of BANDHU THA'P'A and his party, marched to *Pípal Koti* to-day, and was soon followed by JAGRU'P jamâdár and his party.

September 28th.—Thermometer 53°. At 1462 paces reach the steps, which in going up, were an object of terror; but which now surprise us that we should have thought them formidable: this change in our sentiments has been worked by our having become familiar with worse roads, and likewise by the declivity being concealed by grass. Encamp at *Purutkothu*, at 1^h 45′, distance 3225 paces. The *Gorkhas* wished us to pitch close to a small house or fort, they were preparing, to command the road to *Bhadrináth*, and that of the *Jhúla* across the *Alacananda* to *Bandháth*, and the temple of *Kédárnát'h*. The invitation was declined for obvious reasons.

September 29th. Halt this day. We are told that on the summits of the neighbouring mountains there was a large red tiger, which feeds on elks and the largest kind of game, but seldom comes to the lower part of the country. He is described to be of the size of a small horse, his neck is covered with hair so long as to fall over his face and almost conceal his head, as he comes down hill. From this account, it is presumable that the animal is a lion.

September 30th.—Thermometer 60°; noon, 78°; night, 68°. This land was given by the *Rájás* in *Jaghír* to *Bhadrínáth* for the maintenance of the officiating priests; and the *Gorkhas* have not disturbed the tenure, through they live at free quarters upon the farmers, when they come either to collect rents in the neighbourhood or for any other purpose, as in the present instance, when a force is collected to impose upon us a belief of their strength.

October 1st.—Bhawaní Sing, by message through Harkh Deo, requested us to be particularly on our guard against treachery, which he apprehended would be employed against us. The *Gorkhalis* having sent some coolies, we marched with due precaution, our fire arms loaded, at half past two. At 1135 paces encamp on a narrow plot of grass formerly cultivated.

October 2d.—Thermometer at sun-rise 51°; noon 82°; night 61°. This day about 11h, the subadar came to pay us a visit. He is a relation of the deposed *Palpa Rájá*. It is worthy of notice, that two thirds of the troops of Bhacti Tha'pa', consist of the natives of the subjugated countries.

October 3d.—Intermitment fevers are very common at this season, and attributed by the inhabitants to the rain which falls almost continually at the end of *Bhadon*, and the great moisture of the soil. But to the humidity of the atmosphere and the ground, may be added, the vegetable trash they eat, and the close and filthy state of their houses, and especially the accumulation of all kinds of dirt round their habitations.

October 4th.—Went, accompanied by a few *Gorkha sipáhís*, in pursuit of bears; saw and wounded several.

October 5th.—A letter had come from Bandhu

THA'PA' stating, that, as he desired much to meet us, he wished we would march as soon as possible, and he would wait for us at *Chandpúr*.

October 6th.—No coolies came. The jamâdár said, we should certainly have them the following day.

October 7th.—Thermometer 60°. At 9^h begin our march. As I thought it probable, that I should not be able to overtake the goats before night, and as the road was bad, and the sky looked wild and threatening, I endeavoured, as I passed some rocks, to find out some cavern in which I might take up my lodging, for the carriers were so far behind as to leave me little hope of their arriving with my bed. I saw at a distance from the road a deep recess in the face of the rock, and congratulating myself on my good luck, went to examine it more closely, when I suddenly felt an offensive smell, and proceeding to the cave, found the dead body of a man. In what manner he came by his death, I could not learn from the appearances about him: but, as he was not stripped and had white clothes, I suppose he was some pilgrim from *Hindústan*. At 8900 paces, I found the goats on a sandy and stony part of the bed of the *Alacanandra*. My bed arrived about ten o'clock, and my tent in the middle of the night. The *Bichárí* pretends to be our friend, and recommends us to be on our guard. We set fire to piles of firewood, in order to keep off the leopards.

October 8th.—Thermometer 56°. March at 9^h. The deserted condition of the villages threatens this unfortunate country with the loss of all its inhabitants, if it remain under the dominion of the *Gorkhális*. It is odd enough that every governor, and indeed every *sipáhí*, sees what is to happen, but no one seems to make any attempt, on principle, to check the threatened depopulation. The governors of the different districts remain in them but for a few years, and it appears a maxim with them to make

hay whilst the sun shines, whatever ills befall the unfortunate *rayat* from their exactions. Thermometer at night 65°.

October 9th.—Thermometer 59°. It began to rain briskly soon after I commenced my march, and continued two-thirds of the way. The road lay through a country, that once was highly cultivated, but which exhibits now little more than traces of what it has been. This day I found two men under the *Pippal* tree near the *Nandákní*, who wished to become my servants: one of these was a one-eyed fellow who had assisted in carrying our loads from *Najìbábád*. As they seemed strong enough to be useful as carriers, and said they were starving in this country, had no connexions, having lost their wives, I took them into employ. Having mentioned the general features of the country, we went through this day, in our route upwards, it is unnecessary to say more than that the luxuriant vegetation had so altered its face in many places, as to render it a work of some time to recognise them. After a very complete wetting, the feel of the sun which showed itself nearly unclouded, near *Karn Prayág*, was not unacceptable. We reached the *Pindar-Gangá* at 6357 paces, when we crossed the *Jhúla*. On the opposite side, on a stone *Chabútra*, under a *Pippal* tree, we found BANDHU THA'PA', who rose at our approach. He is a stout old man of seventy, plain in his manners and dress, and altogether not superior in his appearance to one of the *zamíndars* of *Gházipúr*. He sent word by the *Bichárí*, that when we had eaten and taken some rest, he would wait on us. He came in the evening accompanied by the *Bichárí* and the *Kamuníah*. On inquiring what were the motives for our passing through their country, we replied, that we wished to see the horses of the *U'ndés* and to procure some shawl wool goats. Why did we disguise ourselves? To this it was answered, that he must well know it was the general custom of pilgrims so to do, but that we had a farther inducement, for, if this had not been done, we should not have been able to enter

the *Undès*, as he must not be ignorant that all entrance to that country is interdicted to the *Gorkhális* and to *Europeans* also. Why, he next asked, had we not applied for a *Parwáná*? Our answer was, that had we waited the time necessary for procuring a *Parwáná*, the season for going through the *Hímáchal* would have passed; but that had we found the horses required, we should have applied regularly for permission for going through the *Gorkháli* country. We then inquired, if he had to complain of our having committed any violence or irregularity in the course of our march. He answered in the negative. He was then informed, that hundreds of the *Nipalese* went through the Company's provinces in any direction they pleased without interruption. He admitted the truth of the remark, but said that he wished us to remain five days at *Karn-Prayág*, and afterwards said that this period might extend to fifteen or seventeen days, until a decision should be formed by the different chiefs as to the line of conduct to be taken. We said that we had been much detained at various places on different pretences, that our money was nearly exhausted, and that we could not make any further halt than one day, when we would proceed towards *Páli*, where we would halt two days. He said, that he was obliged to go to *Sirínagar*, on account of the *Das'hará*, and we might not find any bearers the next day, but that we might depend upon them the following day; and that he would order the *Bichárí* to attend us to *Chilkiah*. We parted apparently on the best terms; and BANDHU THA'PA' was much pleased with his present.

October 10th.—At 8 o'clock BANDHU THA'PA' set off in a *Dandi* or blanket, collected in gathers at the two ends and tied to a long pole. He was carried by two men, who must have been abundantly loaded, as he cannot weigh less than fifteen stone. The town of *Karn Prayág*, contained many inhabitants in 1808; but, at present, a few *Brahmins*, who attend the temple, and some *mullahs* who take care of the *Jhúla*, constitute the whole number.

October 11th.—Thermometer 55°; noon 80°; night 61°. After having completed 3358 paces in a southerly direction with some easting and westing, we encamped near a *Pippal* tree, having the *Pindar* on our left, and the *Chandpur* nullah emptying into this river in a broken stream a little before us, and about a quarter of a mile below our former ground of encampment. The soldiers along with us have scarcely any cartridges, and would have the worst of it, were they to attack us, but I trust this is not their intention, although I perceive their numbers are increased.

October 12*th*.—Thermometer 50°; night 57°. A servant, I had brought from *Pípal Kóti*, had been several times at *Adh-Bhadrí*, and stated that the road on the right side of the *Chandpúr* nullah was shorter and better than that by *Tope* or *Támbá Kóti*, and that the people from this part of the country always went by this road. As it was a great object with me to save distance, I resolved to go by this road; my companion determined to go by the other. I considered this a matter of little consequence, as the separation would only be for a few hours. Whilst on the road, a stout *Gorkhálí*, whom I had not before seen, and who from his dress appeared of a rank superior to the rest, spoke to me in a very insolent tone, and placed himself in a menacing position, striking his musket violently against the ground. I snatched my gun from my servant, cocked it, and stopped with the intention of shooting him if he advanced a single step towards me. Another soldier, seeing what I was about, ran, begged me to desist, and abused the man who had been impertinent. The village was on a very high spot. I left my goats a few yards behind, and with my *Khalásí*, Cheta, went into a square flagged, on two sides of which were low buildings for cattle, and in front a high *Chabutra* connected with some houses. On the edge of this stood twenty-five *Gorkhálí Sipahís*, principally new faces, and on the flags

below were my loads. I asked who was the head of this force, and, on his being pointed out, asked him what was the meaning of this deception. He said it was expected that I should halt there, and every thing was ready for my accommodation; I told him, that it was my intention to cross the *Chandpúr* nullah, that night, and desired to know if he meant to furnish bearers. He answered, that no bearers were to be had, and that it was impossible from the lateness of the hour to reach *Chandpúr*. I saw that nothing was to be expected in the way of aid. A guide was even refused. I, therefore, ordered my people to throw away my things of least value, divide the rest, and march.—Well aware that it would be impossible for me to reach the banks of the nullah, as the night was setting in, I pitched my tent on an elevated spot close to the *Math*. I placed a sentry on each road, and had a fire made sufficiently large to throw light upon them. My men were placed upon the *Chabutras*, and altogether my position was more respectable than could be expected on such an emergency. The fakirs, who live at the *Mat'h*, desired us to be watchful, as a very large tiger had lately taken off three men from that neighbourhood.

October 13th.—The night has passed in quiet. I marched about 9, and in about an hour over a descending and slippery road came to the steep bank of a water-course; Mr. H. sent a note, stating that he had been stopped at the village of *Tope* yesterday, and desired to go to where I was. This he refused, and by shewing a firm determination to proceed was not opposed, but the *Gorkhális* left behind, at the moment of his going on, were busily engaged in putting flints in their guns. He had reached *Adh-Bhadrí*, was under arms and desired me to join him as soon as possible. In about an hour, I found Mr. H. encamped in some flat ground between the temples of *Adh-Bhadrí* and a nullah. In a short time the carriers from *Bandólí*, most probably instructed

by the *Gorkhális*, all at once started up and ran off. It is believed, that this was done to delay our marching. We here disencumbered ourselves of the least valuable of our property, and divided the rest amongst our servants to carry. In the evening we set off. The *Gorkhális* soon followed us. We were overtaken just as on the point of leaving our ground, by HARKH DEO, who said KAṄAK SINGH was in the rear of the loads, which moved very slowly. We reached the *Mallsí* mulberry-tree. The *Gorkhális* encamped about a hundred yards above us. The march of this morning was about 4000 paces, that of the evening 2500.

October 14th.—Thermometer 48°. At 3500 paces I reached the summit of *Dewáli-kalki Gháti*, having for the last mile proceeded through a fine forest of horse-chesnut, walnut, ilex and rhododendron of the red kind. Many people have, it is said, been killed by tigers at this spot, within the last three months. At 5058 paces, cross the rivulet. Here we stopped to eat some *dál* and rice. Instead of stopping near us, as heretofore, the *Gorkhális* proceeded about two miles in front to dress their victuals, and to make arrangements for stopping us at the *Sobha* pass. Had we not been embarrassed by our goats, a march across the *Gadra* to the right, leaving the *Rámgangá* to the left, and steering towards *Langúr* green, would have completely disconcerted their schemes, and have brought us into Mr. H's *jaghír* near *Láldáng*. However, circumstanced as we were, it only remained for us to persevere, until we should have gained the *Sobha* pass, beyond which it would be difficult for them to stop us. After taking our frugal meal we proceeded. The distance from our halting-place is 2600 paces, and we encamped upon a flat on the left bank of the river, where we were met by some *Domes* with musick. At night a farmer brought his son that was sick, and expressed his concern at our situation, believing us in confinement. When it was explained that this was not the

case, he said, that it must happen, as all the troops were to meet at *Sobha*, and detain us there, as they had failed of effecting their purpose before. Orders had been issued to all the farmers to assist them, in case we should resist them. Here again our escort departed for the night to a village at a distance, and had we not had the goats, we might have availed ourselves of this opportunity; but I had determined, as long as it might be in my power, not to quit the animals which it had cost me so much pains to obtain.

October 15th.—Hoar frost, thermometer 47°. I marched with the goats. After having gone about a mile, I observed, that I had passed on the right, and below me, a body of about 80 or 100 men armed with muskets. They were evidently surprised, and hurried much to overtake me. I fell to the rear of the goats and continued my pace; a man asked me where HEARSEY sahib was, and desired me to stop. I asked him who he was, and by what authority he took the liberty of interrogating me. He replied that he was the jamâdár of the party, and was sent to prevent our proceeding until his subadár and the principal zemindárs of the country have a meeting with us. I told him, that I was proceeding quietly on the high road, molesting no one; that I expected not to be molested, and that I should resist in the best way I could any attempt to stop me by force. That we had promised BANDHU THA'PA' to stay two days at *Palí*, and that we should stay that time according to our word. He then dropped his tone, and requested me to order my people not to go on, which I refused. As the soldiers had gathered round me, and were closing, I told him that if he did not order them to go to a distance, I should consider myself attacked and act accordingly; and advised him to reflect on the consequences which might ensue by his forcing me to defend myself. He ordered the soldiers to keep farther off. I continued to march, followed by the whole

of the party. After reaching the bank of the river which was forded, a man of BANDHU THA'PA's party came to know if I wished the goats to be carried; for this civility, I thanked him, but declined giving him any trouble, save that if any of the goats should chance to be carried down the stream, that he would order his men to stop them just above a rapid at a short distance. I continued my march, when the jamâdár said that if I would stop only one day, opposite SUME'RU's house, the meeting would take place, and we might proceed. I refused to stop any where short of *Mehelchowrí*. In half an hour more I saw a large new house half way up the hill on the right, and on the plain close by the road the party of soldiers was assembled, they having preceded me from our last conversation; a tall man, whom I understood to be SUME'RU, came forwards, made a salam, spread a blanket, and begged I would go to his village until the subadár should come. I said that I was upon the principal road; and I was determined not to leave it until I should arrive at *Mehelchowrí*. He requested me to stay only one day, during which the business would be settled. I told him we had been much deceived before, and at *Pálí* only would we halt willingly. I resolved to wait for my companion coming up, that we might defend ourselves with more advantage against the force which now amounted to as much as the country could muster. Wishing likewise to draw SUME'RU away, I gradually, whilst conversing, walked back again and he followed. At a proper place the note from D. S. was given. He said he knew its contents, and would furnish provisions and bearers, if we would only stop one day. In a short time Mr. H. came up; he was of opinion, we ought to get beyond the *Sobha* pass, as if they failed to stop us there they could not have an equal opportunity elsewhere. I agreed with him and took charge of the advance, whilst he brought up the rear. The goats were with me. A body of *Sipáhís* ran before to gain a narrow part, which confined the path. One went through the

goats; I followed to push him from amongst them, and found about twenty men had formed a line upon the path. The man I had pursued, probably exasperated by being obliged to run in the sight of his countrymen, put himself in a menacing position on the path. I retired a few paces, dropped on one knee, in order to get a steady and low aim, when another advanced humbly, and the person, who appeared so resolute, threw down his musket and presented his neck also. I ordered the soldiers to quit the path, and they drew up on the side for me to pass. Whilst this was going on, Mr. H. was engaged in warm conversation with the *Sipáhís* behind, had formed his few men into two divisions, and agreed to no other terms than those I had before proposed, viz., that we would go to *Mehelchowrí* and wait there the remainder of the day. To this place we went; and, having only made 4500 paces, encamped under the shade of a mulberry tree and salinga tree, close to the habitation of a *Gosain*. This personage was tall, thin, with a long beard and about eighty years of age. He approached with much respect, and desired me to sit down on part of the *Chabutra* under the mulberry, surrounded by stone figures of deities. In a short time bringing a pomegranate, he particularly requested that we would stay a few days, as violence would certainly be offered if we did not. He represented himself to be an inhabitant of *Oude;* and, after residing here forty years, was anxious to die at *Benares*. He was tired of living in a country where religion was neglected, and every thing tended to desolation. In the evening a *Brahman* who was called a major, and who we understood executed the writing business belonging to the Company, now made his appearance with a message from the subadár, stating that to-day he was much engaged in ceremonies of ablution and worship, but that early in the morning he would certainly wait on us. To this we replied, that we had made a very short march to accommodate him, that he had not come agreeably to his promise, and that if he were dis-

posed to see us, we would wait for him at the *Khutsar Gudrah*, on the south of the *Sobha*.pass. The major represented, that it would much gratify him and the whole party, if we would stop here four or five days. This we positively refused. The old pandit was very desirous of our stay; but, as we plainly perceived that time was all the subadár wanted, we resolved to persevere. The appearance of one of Mr. RUTHERFORD's agents, who said he was come on his master's business, makes us disbelieve the report of there being any rupture between our government and the *Gorkhális*, and makes us still more desirous to avoid actual hostilities.

October 16th.—Morning very foggy. Thermometer 52°. We were stirring very early, and as the *Gorkhális* were round us in considerable bodies, I had my breakfast placed on a stone and ate it, with my gun in my hand. Many jamâdárs and havildars came round Mr. H's tent, and the soldiers closed. I called to the principal jamâdár, and said, if the soldiers did not immediately retire, I should look upon their presence as an hostile aggression, and act in consequence. Seeing me thoroughly prepared, several of the officers came, offered their necks, and desired me to take off their heads, as if they did not stop us that would be their fate: observing that many had got round me, I stepped away from them; and the servants, who had been sent off with the goats, said they were not allowed to proceed. I then saw that a body of about thirty had barred the path, were forming in a semicircle, and coming on to attack us. I called to my companion to prepare, and sprung into the path, desiring the soldiers to stand clear. The main body opened a little, and I independently advanced with too much impetuosity. A man or two advanced, and I shoved them back. My gun had in an instant as many hands upon it, as could find room to touch it, but they could not wrest it from me. I had at least seventeen or twenty upon me, but this rather prolonged than shortened the contest, as they

pulled in opposite directions. It would have been maintained for even a longer time, had not one man got upon my neck and stuck his knees into my loins, endeavouring to strangle me with my handkerchief, whilst another fastened a rope round my left leg and pulled it backwards from under me. Supported only by one leg and almost fainting from the hand round my neck, I lost my hold on the gun, and was instantly thrown to the ground. Here I was dragged about by the legs until my arms were pinioned. When I had got up, nothing could surpass the savage expression of joy depicted in the countenance of the victors; nor was the ferocity of their actions much behind-hand. For fear of my getting loose, two soldiers held me fast by a cord, and every now and then gave me a violent jerk by way of letting me know my situation. I desired to be placed upon the *Chabutra* out of the crowd; and, after some hesitation, this was complied with. Mr. H., it seems, had little suspicion of so immediate an attack, as he was washing his mouth when the affray begun, and did not hear my call to him. Our servants were absent from the small pile of arms we had. I had only one armed man in my suite, having given over my other double-barrelled gun to Mr. H. for his own immediate use; and to my servant who had a long duck gun, I had given the most express orders not to fire unless the *Gorkhális* fired first. Mr. H. and the whole of our servants, except two or three who escaped this fate, I know not how, were secured; Mr. H. was not bound, but secured by persons holding his arms. Some of the others were struck with the butt ends of muskets and much maltreated. In about two hours, during which I remained bound, the subadár made his appearance. He seemed quite a beau, just stepping from his toilette, saluted all the soldiery with a simpering smile of exultation playing on his countenance. He did not deign to salute either Mr. H. or myself, and we were certainly not in the humour to pay any compliments. After casting upon us some looks of survey, he retired to hold a council.

In a few minutes he came again, and having a carpet spread near Mr. H., seated himself upon it and entered into conversation. I asked him, whether the rope ornaments placed round my arms were the bands which connected the friendship of the *English* and the *Gorkhális*? Whether this was a conduct that was justifiable towards a traveller who entered into the country peaceably, who had demeaned himself in the most peaceable manner whilst he remained in it, and was returning peaceably towards his own home? To this he asked, why I went through the country in disguise? I answered, to avoid expense, unnecessary delay, and to enable me to get into the *U'ndés*. During this time I remained bound. He desired me to be seated: this I refused, until the cords were taken off my arms; which he ordered. The excuse he urged for not coming before, was that the day was one of great religious ceremony. If so, I observed, what reason was there for his having delayed not making his appearance till so late an hour, it being now near twelve. He stammered out some imperfect apology. I pointed out the bound people, and desired that either they might be unbound, or that I might be re-shackled. He said, that they all should be set at liberty; and two or three were loosed. In about half an hour the subadár left us, and after a long consultation, in which jamâdárs, havildars, and sípáhís bore a part, a letter was written to Bam Sah at *Almora*. This cowardly fellow had prudently kept himself out of the way, till the scuffle was over. By acting as we have done, we have got into a part of the country less remote from the plains, and more in the way of sending information of what has occurred. In the evening, our low country servants were unbound; but those we have hired to bring on our baggage, were still bound, as well as the *Pandit* and his nephew. The former acted with firmness, the latter was much cast down. I desired that some of my servants might go to attend my goats. This was acceded to. On looking over the events of this day, and reflecting on the consequences

which may result from them, I cannot but be grateful to the Author of all, for having given me firmness to bear my present situation without the dread of the death, now likely to cut short my career. About fifty people are set to guard us; and they are so noisy as to afford little chance of sleep to-night.

October 17th.—This day was ushered in, by the hammering of a blacksmith preparing fetters. In the forenoon, the two *Pandits* were taken away, as we apprehended, to be put to the torture; however in this we were mistaken, as it was for the purpose of placing one leg in a square hole cut out of a heavy log of wood, and a strong peg being driven across the two sides of the notch retained the foot. Several of my servants, were shackled in this manner; and of Mr. H's. One of my bearers offered to carry a letter, as also did my goatherd. This man came up as a fakír, the second day after we had come over the *Nítí* pass, and said he would take service, provided I would furnish him with victuals till we should reach the plains. He purposed going to the subadár, saying that he was a fakír, had only accompanied us for his victuals, and wished to depart. If he got permission, he said he knew what road to go by, to prevent being stopped at any of the *Gorkhálí chokís;* and should, bating accidents, reach *Chilkíah* on the third day. I wrote a letter to Sir E. COLEBROOKE, open, relating the general circumstances of our situation, and that the only matter which could be laid to our charge, was going through the country in *Hindu* dresses. This, along with one from Mr. H. to his brother-in-law, Lieutenant SALMON, were put into a piece of my orange-coloured mantle, and sewn within the doubles of an old woollen wrapper, in which the fakír kept the instruments he used in prayer. He made his representation to the subadár, but was ordered back into confinement. This did not disconcert him. He was confident that he should be able to execute the commission he was charged with.

He said that he had eaten my salt, would not be ungrateful; that he should not stop here, but having his beard shaved, and having changed his dress, he should proceed with an answer to *Almora*, or wherever we might be. He left me, and I suffered an hour to elapse before I looked for him. He was then sitting down on the ground with his blanket on his head, and arranging some wood in a bundle, as if for cooking. When another hour had passed again, I saw the heap of wood with a bundle of clothes laying by it, close to one of the sentries, but the fakír had disappeared. Should he succeed, we owe him great obligation, as the probability of our deliverance depends almost entirely on the representation Sir E. COLEBROOKE will make to the chief of *Almora*. We desired the subadar to allow the major to write a letter from us jointly to the *Choutra*, BAM SAH, stating in general terms, that as we had been imprisoned, and bound by his order, we desired to be taken to *Almora*. We enclosed a note to Mr. HAWKINS, mentioning the imprisonment, and requested the *Choutra* to forward it to that gentleman. I gave the major a pair of scissors for his trouble, and a rupee to each of the two soldiers, who were going to *Almora* with the letter. A reward of three more was promised if they brought us an answer on the fourth day. A considerable number of farmers was brought together by order of the subadar, in order to show them the punishment he had inflicted on the *Sahib lóg*; commiseration was depicted in their countenances, which formed a striking contrast with those of our guards. The old *Gosain* continues his kindness in bringing all the milk his cow gives, morning and night. This is very little; but it shews his will.

October 18th.—About 10 o'clock, the fakír was missed. A great noise was made; and a strict search for about an hour; and persons sent out in every direction: however, I trust, that our messenger will have got completely out of their reach. This escape has made them doubly vigilant, and a man looks into the tent every hour at least.

October 19th.—The old *Pandit*, his nephew, and our hill servants, were released from their logs, but had their hands bound and were taken away to *Almora*. To the *Pandits* I gave presents of money, and an order for a further sum on my agent; and in the event of their deaths, I made a provision from my effects for the maintenance of their families. We were told that our low country servants should now be released from their logs. An abbatis of stakes interwoven with brush wood was made round. The stakes, being only driven straight down, might easily be drawn up. I mention this, because, after the *Gorkhális* have made an attack, they usually entrench themselves in this manner.

October 20th.—Thermometer 45°.

October 21st.—The fogs are said to hang over the *Rámgangá* at this season, for about half this month: when they disperse, they are very dense and penetrating. One of the hill servants I hired as a cooly on the banks of the *Nandákní* arrived with his load. He had been sick and obliged to stay at a village behind. The other man TILAK, now gone to *Almora*, said that we might rely upon his honesty and fidelity; and he has given a proof of it, as, if he had been dishonest, he might have gone off with his load unmolested: but though evincing some little courage in coming to persons in captivity, after learning the fate of his comrade, we find it is confined to this, for on sounding him as to taking a letter to *Moradabad*, he expressed his fears, and though apparently recovered, cited his illness as one cause for his not undertaking the journey.

October 22d.—Our servants were this day released from their logs and had more liberty allowed them for moving about. Seventh day of imprisonment.

October 23d.—In the evening the two jamâdárs arrived with a letter from BAM SAH. This acknowledged the

receipt of our letter, and a copy of an order from *Nipal*, stating that having heard that two persons had gone towards the *U'ndés* in disguise with guns, &c., BANDHU THA'PA' was ordered to stop them on their return, and know their business, and who they were, and also to detain them till an answer should be received from *Catmandu*. The jamâdárs said that they were surprised we had gone privately when we might have commanded the country. We returned the same answer as to BANDHU THA'PA', that it was to avoid delay and inconvenience; but from all I have seen, I am thoroughly convinced, that, if we had applied for permission, it would not have been granted.

October 24th.—The jamâdárs, who brought the letter from BAM SAH, came this morning to say that they had orders to procure whatever we might stand in need of. The jamâdárs pretended to express astonishment at the severity of the usage we had met with, which they said was not agreeable to the orders the subadar had received; and stated that this had not been reported to BAM SAH.

October 25th.—A letter to BAM SAH was finished and sealed. We determined to send KANGH SINGH with it, that we might be sure of its reaching BAM SAH, and that he might fully represent the treatment we had experienced. A half kind of consent was given to this by the jamâdárs. A copy of our former dispatch to Sir E. COLEBROOKE, to which were added recent incidents, was given to the father of a boy, whom I had relieved by tapping for dropsy. He said, that he should go to his house immediately, would place the letter in the sole of one of his shoes, and carrying these in his hand, would reach *Chilkíah* on the third day.

October 26th.—This evening we took a walk out of the northern gate of the abbatis, and prolonged it for

about an hour, in order to reconnoitre the adjacent country, for the purpose of attempting our escape should there appear a necessity for the measure. Our guards apparently did not miss us for the first half hour, when our absence gave them much alarm; and suspecting we had actually effected our escape, people were sent out in every direction to apprehend us. The attempt to escape from hence would be difficult, as in such case we must proceed completely through the wildest part of the country; and almost all the small watercourses, by which the mountains are separated, serve as the retreat of bears and other wild beasts.

October 27th.—When we reached this place, the sides of the mountain were beautifully green; but in this short space, by the night frosts, they have assumed the russet livery of autumn: so rapid is the change of season in this country.

October 28th.—Early this morning a jamâdár came into our tent; and seating himself, said the object of his journey was to convey us to *Śrinagar*, where AMR SINGH wished us to be. This man brought no letter; and his interference was evidently the cause of some perplexity to our jamâdárs. AMR SINGH is the head of the army; and BAM SAH, the chief of these districts.

October 29th.—The watchfulness of our guards has not in the least diminished. A zemindar brought to the troops some *Ghee* for sale. Some one complained, that oil was mixed with it. The servant of the owner was laid hold of, and through fear of being punished, if he did not confess that his master had adulterated the *Ghee*, made an accusation to this effect. The supposed culprit was seized, stripped, bound, and flogged severely with thongs. The *Ghee* was confiscated for the use of the soldiers; and twenty-five rupees as a fine were ordered to be paid as

the fine to the subadar.—Should the poor wretch not be able to pay this in money, his cattle or children will be seized to the amount, and the value will be paid by the person who is to benefit by the property.

October 30th.—To-day more troops reached us from *Sirínagar ;* and we have with us in all about 190 men.

October 31st.—Another jamâdár now came with a few men, saying that he had the orders of BANDHU THA'PA' to proceed with us to *Sirínagar*, from whence we were to go to *Haridwár ;* and that on the road we were to be met by RANJUR KAJEE, the son of AMR SINGH. Although BANDHU THA'PA' did not write, we thought it right to send him a short letter, stating that as we now were on the high road to *Chilkia*, it would be highly inconvenient for us to leave it. This jamâdár is about sixty, of a more frank character than any of his brethren we have met with, and is employed in going through the district to prevent the farmers running away. He said his efforts to give confidence to the farmers were ineffectual, and the orders of the *Rájá* were disobeyed. An order had been issued under the great seal of the prince, in consequence of the great loss in the population of *Garwhál*, prohibiting the soldiers from taking any of the inhabitants as slaves: but this was wholly disregarded, and the soldiers always escaped the punishment with which they had been threatened. Living in free quarters, without receiving any check for their conduct, the soldiers had, the old man observed, so far oppressed the country, that where there were formerly twenty-five families, now only one was to be found.

November 1st.—The jamâdárs from *Almora* came at an early hour, to report that orders had arrived from BAM SAH to return all the things which had been taken from us ; and after the lapse of about two hours, they returned with the guns, &c. We now found ourselves in the way to liberty, and resolved not again to part with our arms

except with our lives, This day our hill servants arrived. The old *Pandit* and his nephew were in irons, but were furnished with victuals by BAM SAH.

November 2d.—Hoar frost. Thermometer 36°; night 60°. We made preparations for marching at 9^h 15′, left *Mehelchowri*, and ascended the *Sobha* pass. At the foot of the descent from the *Sobha* pass is the *Khatsúr* valley, and half way down is a knoll of calcareous rock, the western side of which, about thirty feet high, and overhanging the base, forms a shallow cavern attributed to one of the *Súrs*. From chinks in the stone exudes a small quantity of black bitumen. The *Khatsúr* valley is about a mile broad: in the middle the edges are full of springs, the water of which is collected for irrigating the flats. This valley produces the *Bansmatí* rice, next in quantity to that of *Chúkam*, and would give vast crops of hemp of the finest quality. We pitched on a rice flat, on the right bank of the *Rámgangá*, opposite to a small village called *Jhalah*. KANGH SINGH overtook us here with a letter from BAM SAH, stating that his son was on the road to meet us; that our ill treatment did not proceed from him, and that the authors of it should be severely punished.

November 3d.—Thermometer 41°; night 69°. March at 10; we encamped under a *Pípal* tree a little below *Mashí*, on the left bank of the *Ramganga*. The top of *Ghensálí ka Ling*, covered with snow, was very visible in a Northern direction. Our supposed march to-day about seven miles. There was here an immense quantity of fish. The people place loose bundles of rice straw in the river, and keep them down with large stones. The fish, coming into them to deposit their spawn, are seized by the hand before they can get from within the straw. In front up the hills are three ovens for extracting tar; but the pines are small, and of course do not contain much turpentine.

November 4th.—Thermometer 50°; night 62°. The son of BAM SA'H was announced just as we had finished dinner: when he came, preceded by an old man repeating his titles, &c., and five or six bazar girls. His name is LACHBÍR SA'H, about twenty-six or twenty-eight years of age. He was dressed in fine *Dacca* muslin, and had about twenty shabby orderlies in attendance. He expressed the concern his father was under, at learning how we had been treated; and was anxious to have us believe, that the *Sipáhís* had acted not only without his father's orders, but even without any orders at all. He appeared desirous, we should say we forgave what had happened, and the persons who had committed the outrage should be punished; we requested that the *Pandits* might be released, and stated that we were unwilling that servants should be punished, for having acted agreeably to their orders. LACHBÍR SAH said, that he would make a severe example of the soldiers, who had been most active in seizing us, if we would point them out. It was obviously his intention to have given up a few of these wretches to condign punishment, in order that we might have the odium and consequences of the act, and that his government might retaliate upon the *Pandits*. It was stated by us, that we should derive no pleasure or satisfaction from the immediate agents being punished; but we should be glad to know the authors of our arrestation, who were principally to blame; and we farther said, that, as far as we were concerned, we should forgive the men, provided the *Pandits* were immediately returned, so as to quit the country with us. He said he would write this proposition that evening to his father, and wished us to stay till a messenger should return from *Almora* with an answer. He said that DASRATH BAKSHÍ had written to *Nepál*, that we had taken up between 4 and 500 men with muskets, &c., had erected forts on the border between *Bóthant* and the *U'ndés*, and were endeavouring to raise the *Marchas* and *Unías* against the *Gorkhális*.

November 5th.—The jamâdárs last night requested, that the subadars might be furnished with a certificate of their good conduct toward us. We said that we had no objection to give a certificate of the good behaviour of the one, and that we pardoned the other, provided he would ask pardon of the old *Pandit* for the treatment he had experienced from him and his soldiers. LACHBÍR SAH came in the afternoon, and announced the receipt of a letter from the *Rájá* of *Napál*, ordering us to be seen safe out of the country with all our effects, and that we should be treated with civility. He observed we were at liberty to depart whenever we might think proper.

XI.

On the Dryobalanops Camphora, or Camphor-tree of Sumatra.

BY H. T. COLEBROOKE, ESQ.

IN the fourth volume of the Researches of the Society, in an essay on the express subject, the camphor of *Sumatra*, is stated to be 'the produce of a tree growing on the north-west side of *Sumatra*, from the line to 3° north.' A familiar description of the tree is given, on the authority of a gentleman, who long resided at *Tapanooly:* and its botanical place is assigned 'in the class *Enneandria Monogynia* of LINNÆUS, differing however in the form of the leaf from the *Arbor camphorifera Japanica*, and much resembling the bay in leaves *'.

It is evident, that the author of that essay (M. MACDONALD), or the person from whom he derived his information (Lieutenant LEWIS), considered the plant in question to be a laurel; as the camphor-tree of *Japan* is described to be †. But, as neither of those gentlemen

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* *Asiatick* Researches, 4. p. 19.
† Kœmpf. Amœn. 770, Thunb. Jap. 172.

seems to have been conversant with botany, it continued to be far from improbable, that the botanical character of the plant might have been mistaken by them; and that it was referred by the author of the essay cited, to the genus *Laurus*, or to the class and order to which that genus belongs, upon no other foundation but a preconceived notion grounded upon the existing information concerning the camphor-tree of *Japan*. It was the less unlikely, that the two plants might belong to different genera, or even to different orders, as camphor is well known to be a production of a great variety of plants, though in a less pure state, and not so readily and abundantly afforded; and as it was observed by KÆMPFER, in speaking of the *Laurus camphorifera*, and of the extraction of camphor from its wood and roots with the aid of the heat, that "natural camphor, in substance and of greatest value, is furnished by a tree on the islands of *Sumatra* and *Borneo*, which is not of the *Laurus* genus." "Camphoram naturalem et cristallinam perquam pretiosam ac raram impertitur arbor in *Sumatrâ* et *Borneo* insulis. Sed hæc arbor ex Daphneo sanguine non est*."

Considering then the specific character of the camphor-tree of *Sumatra* to be unsettled, and the generic character dubious, botanists in *India* have been long solicitous of more correct and definite information on this subject, and Doctor ROXBURGH in particular was at great pains to procure living plants with specimens of the fructification. His endeavours had not been successful at the time of his quitting *India*: but he had received a rough sketch of the fruit and leaf, from the appearance of which he was led to name the plant *Shorea camphorifera*†; and his conjecture, as will be shown, was not very remote from the truth.

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* Amœ. Exot. p. 773.

† "Shorea camphorifera. ROXBURGH. Sp. char. Leaves oval, acuminate, parallel-veined, smooth; Flowers axillary."—ROXBURGH's MSS.

It has been my fortune, in his absence, to receive from Doctor ROXBURGH's correspondent at *Tapanooly*, (Mr. PRINCE, the resident at that station,) a number of the seeds in very perfect condition, and a few living plants. The latter, I am sorry to say, did not outlive the subsequent cold season: but the examination of the seed enables me to determine the genus of the plant with entire confidence. It undoubtedly belongs to the *Dryobalanops* of the younger GÆRTNER; and is not unlikely to be the identical species, which furnished the specimen inspected by him, and which he named *Dryobalanops aromatica*. GÆRTNER's information indeed states the specimen to have been received from *Ceylon* with an intimation that the bark of the tree is the genuine and best cinnamon. But, as there is every reason to be satisfied, that cinnamon is exclusively produced by a species of the laurel,* the information, which accompanied the specimen in question, may have been in every part inaccurate.

As this point, however, is uncertain, and the specific characters of GÆRTNER's species are unknown, or at least unpublished, it is for the present necessary to allot a distinct name to the camphor-tree of *Sumatra*. I propose therefore to name it *Dryobalanops camphora*, until its identity with D. *aromatica* be established. The description, which I shall offer of it, is unavoidably imperfect, as the flower has not yet been seen by a botanist. But the generic character is so strongly pronounced in the fruit, that there can be no doubt of its place in the same natural order with the *Shorea*, the *Dipterocarpus*, and *Vateria*, to which the *Hopea* of Doctor ROXBURGH is to be added; and most probably in the same class and order in the Linnean artificial arrangement, viz. *Polyandria monogynia*.

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* *Laurus* cinamomum.

This section of JUSSIEU's natural order of *Guttifera* comprises trees remarkable for their aromatic and resinous productions. *Shorea robusta* and *Zambuga*, and perhaps other species of the genus, yield in great abundance the resin called by the *Hindustánis*, *Dhúna*, and by the *English* in *India*, *Dammer*, which is very generally used as a substitute for pitch for marine purposes. The natives of *India* also employ it in their temples in the manner of incense. Dipterocarpus costatus, turbinatus, incanus, alatus, and probably other species of the genus, afford the several sorts of balsam called by the natives of *India*, *Garjan*; by the *Singhalese*, *Dhornatél*; and by the *English*, *Wood oil*. *Vatería Indica* produces the resin in *India* called *Copal*, as very nearly approaching the true resin of that name: the best specimens are employed as ornaments, under the denomination of amber (*Kahroba*) to which it bears exterior resemblance: in its recent and fluid state it is used as a varnish in the south of *India*, (BUCHANAN's *Mysore* 2, p. 476.) and dissolved by heat in closed vessels, is employed for the same purpose in other parts of *India*. Another plant of the same genus, *Vatería lancéæ-folia*, affords a resin, from which, as from other resins, the *Indians* prepare one of the materials of their religious oblations.

DESCRIPTION.

DRYOBALANOPS CAMPHORA. *Cole.*
ESS. CHAR.

Calyx one-leaved, permanent: the five divisions of the border growing into long, remote, reflex wings.

Corol—
Capsule, superior, one-celled, three-valved, one-seeded. Embryo inverse without perisperm.

A large tree, native of forests on the north-western coast of *Sumatra:* and especially in the vicinity of *Tapanooly. Sans.* Carpura. *Arab.* Cáfúr. *Mal.* Cápúr. *Hind.* Cápúr.

Trunk arboreous. *Bark* brownish.
Leaves, superior alternate; inferior ones opposite; elliptic, obtusely acuminate, parallel veined, entire, smooth; 3-7 inches long; 1-2 broad.
Petioles short. *Stipules* in pairs, subulate, caducous. *Perianth* one-leaved; five-parted, persistent.
Capsule superior, ovate, woody, fibrous, finely streaked with longitudinal furrows, embraced at the base by the calycine hemispherical cup and surrounded by its enlarged leaflets, which are converted into remote, foliacrous, spatulate, rigid, reflex wings: one-celled, three-valved.

Seed solitary, conform to the cavity of the capsule. *Integument* simple, thin, membranaceous, thickened along one side and thence penetrating to the axis and continued between the interior folds of the cotyledons. *Perisperm* none. *Embryo* conform to the seed, inverse, milk white. *Cotyledons* two, unequal, almond fleshy, thick, chrysaloid-contortuplicate; the *exterior* one larger, convolute, and cherishing the interior one, smooth without, wrinkled within: the *interior* one much smaller, wrinkled on both sides, reniform or round cordate (as is the exterior one, if its folds be expanded.) *Plumule* simple, conical, two-leaved. *Radicle* near the summit towards the back, columnar, a little curved and ending in a short conical tip; ascending.

The seed has a strong terebinthine fragrance.

The following particulars, concerning the extraction of the camphor, were communicated by Mr. PRINCE, Resident at *Tapanooly*, to Doctor ROXBURGH.

"This tree grows spontaneously in the forests; and is to be found in abundance from the back of *Ayer Bongey*, as far north as *Bacongan*, a distance of 250 miles. It may be classed among the tallest, and largest trees, that grow on this coast; several within daily view measuring six or seven feet diameter. Before it acquire such dimensions its age is conjectured to be — years; but it will produce *Camphor* at a much earlier period, when the tree does not exceed two and two and a half feet in diameter. The same tree, which yields the oil, would have produced *Camphor* if unmolested, the former being supposed to be the first stage of the latter's forming, and is consequently found in younger trees. The natives have no certain means of ascertaining the tree which produces either the one or the other, although there are some men styled *Toongoo Nyr Cappoor* who pretend to that knowledge, but they cannot give any reasons for their judgment, beyond favourable dreams, which superstition has rendered infallible: and it must be admitted that the success of this description of people, in discovering and procuring, is greater than the majority of those who go in search of the *Camphor*: the distinction may have arisen from the peculiar favour of fortune to some individuals over others as in most other circumstances of life, from whence they have acquired a celebrity, otherwise they could give some rational explanation of their superior success. Both *Oil* and *Camphor* are found in the heart of the tree, occupying a vacuum, which, in others, is frequently filled with pitch; but it does not extend to the whole length; on the contrary, they are found in small portions of a foot, and a foot and a half long, at certain distances. The method of extracting the oil is

merely by making a deep incision with a *billiong* or *Malay* axe, in the tree, about fourteen or eighteen feet from the ground till near the heart, where a deeper incision is made with a small aperture; and the oil, if any in the tree, immediately gushes out, and is received in bamboos, or any other utensil better approved of; in this manner, a party proceeds through the woods wounding the camphor-trees till they attain their object. The *Camphor* is procured in pretty nearly the same way. The trees are cut to the heart about the same height from the ground as in the former instance, till the *Camphor* is seen; hundreds may be thus mutilated before the sought-for tree is discovered; when attained, it is felled, and cut in junks, of a fathom long, which are again split, and the *Camphor* is found in the heart, occupying a space in circumference, of the thickness of a man's arm. The produce of a middling sized tree is about eight *China catties*, or nearly eleven lbs., and of a large one, double the quantity. The *Camphor* thus found is called *Se Tantong*. It is often the case that the trees which have been cut, and left standing in that state, will produce *Camphor* in seven or eight years after, which is distinguished by the name of *Oogar*, but is inferior in appearance, though of the same quality. The sorts of *Camphor* called *belly* and *foot*, are the scraping of the wood which surrounded it."

XII.

Abstract of an Account, containing the particulars of a boring made near the River Hooghly, in the vicinity of Calcutta, from May to July 1814 *inclusive, in search of a spring of pure water.*

COMMUNICATED

BY SIR EDWARD HYDE EAST.

The Numerals represent Feet from the Surface.

2 0	Dry earth with soorky (brick dust.)
3 to 6 (Inclusive)	Dry sand with a little clay.
7 — 21	Blue clay, with sand, more or less.
22 — 31	Blue clay, with shear coal.
32 — 52	Blue clay, with a little rotten wood.
53 — 56	Blue clay, with coal.
57 — 0	Very stiff blue clay, with a little conker (gravel.)
58 — 61 (Inclusive)	The same, but the conker mixed in a greenish clay.
62 — 0	The same, without the greenish clay mixture.
63 — 65	Very stiff blue clay, with a little yellow clay, mixed with a little conker.

66 — 68 (Inclusive)	The same, but yellow sand, vice yellow clay.
69 — 70	Stiff blue clay, with a little yellow sand and clay.
71 — 76	Damp reddish clay, with a quarter of sand, with a tinge also of yellow from 73.
77 — 84	Reddish yellow clay, mixed with sand, with a little talc.
85 — 92	Yellow clay, mixed with sand.
93 — 96	Yellow sand inclining to clay.
97 — 100	Blue clay with yellow sand.
101 — 102	Lead coloured clay, with yellow sand.
103 — 105	Blue and yellow clay, with yellow sand and a little conker.
106 — 107	Stiff blue, inclining to yellow clay, with yellow sand, and a little conker.
108 — 113	The same, without the conker.
114 — 118	Stiff deep yellow clay, with a little yellow sand.
119 — 122	Soft deep yellow clay, with more yellow sand.
123 — 125	Coarse greenish yellow sand.
126 — 127	The same, with a little yellow clay.
128 — 131	Coarse dark grey sand.
132 — 0	The same, red and grey.
133 — 138	Dark grey sand, with a little talc, the sand getting coarser downwards.
139 — 140	Coarse dark grey sand.

At this depth the boring tackle having several times given way, and the borer remaining unextricable from the ground, the further prosecution of the experiment was abandoned. The different strata, through which

it penetrated, have furnished the following observations.

1. The primary object of getting at springs of fresh water entirely failed, of which sanguine expectation had been formed by the projector of the experiment, grounded, as it should seem, upon the common opinion, that the soil of all the lower part of *Bengal* was particularly moist and full of springs; an opinion, which this experiment, if it can be taken as affording any criterion of the soil throughout the vicinity of *Calcutta*, has so far happily discountenanced. The first appearance of any damp was at the depth of 71 feet, in a reddish clay with a quarter of sand, and below 76 feet the earth was as dry as before; though the borer must have descended nearly to the level of the sea, which as the crow flies, cannot exceed 70 miles in distance, while the fall of the river is commonly computed at one inch a mile, according to its bendings.

2. The damp of the climate, not being attributable to the moist nature of the soil, nor affected by it, otherwise than as an admixture of saltpetre in the soil may be supposed to have some influence on the exhalations from the surface, must be looked for principally at least from causes upon or above the surface; to the want of a general system of drainage in a level country, and the luxuriant vegetation, with inadequate openings through the woods for ventilation, which prevent or impede the copious falls of rain at the periodical season, and not unfrequently at other times, from running off properly. The heavy dews at other seasons, are not probably more than sufficient to supply the daily exhaustion of the sun, and would rather contribute to the healthiness of the climate. All that seems to be wanting therefore is surface draining upon a general plan, and the cutting of broad straight roads through the woods, as much as possible in the direction of the prevailing winds. The acknowledged

improvement of the climate in and about *Calcutta*, of late years, appears to be the natural result of the superior attention which has been paid by the local police to these two objects, the benefits of which will be extended with the extended application of the same means. The culture of rice could only be partially, if at all, affected by it, and the neighbourhood of towns and populous villages would be much improved by substituting the superior and more wholesome cultivation of potatoes, which seem to be springing into general use every where with the increasing population of the world.

3. On the deepening of the great tank at the beginning of the *Chowringhee* road in the last year, there was found a quantity of decayed wood at the depth of 35 feet below the surface, which was imagined at the time to be an accidental circumstance, of which no satisfactory account could be obtained: but the borer, in this experiment, having perforated rotten wood in a stratum of blue clay from the depth of 32 to 52 feet, at the distance of half a mile from the former spot, gives reason to suppose that the remains of an ancient forest forms a substratum of a more general extent at this depth, and supports the theory, which has been drawn from the like discoveries in different parts of the world, that some great convulsion of nature, probably the deluge, prostrated and covered the ancient forests.

4. The finding of this layer of rotten wood between layers of coal, seems to support the supposition, that coal is a formation from wood, probably gradual; the middle parts being the last transformed: or possibly the transforming principle, if lying in the adjacent earths, may have been in this instance exhausted before it reached the middle part of the wood.

5. There is no trace of any volcanic matter throughout all the different strata penetrated by the borer to the

depth of 140 feet; which renders it probable that the shocks of earthquakes not unfrequently felt in this part of *Bengal*, (whether such phenomena proceed from the direct action of fire, or from the sudden contact of heated substances with water in the bowels of the earth, thereby expanding into vapour; and not merely, according to Doctor STUKELY's hypothesis, from electrical shocks on the surface,) do not proceed from any very proximate cause; and the general feebleness of those shocks leads to the hope that the cause is remote, and consequently that the effect is not likely to be severe. The *Monghir* hills, which are said to contain volcanic matter, are at the distance of about 300 miles.

XIII.

Statistical View of the Population of Burdwan, &c.

BY W. B. BAYLEY, ESQ.

H. T. COLEBROOKE, ESQ.

PRESIDENT OF THE ASIATICK SOCIETY.

SIR,

I HAVE the honour to submit to the *Asiatick* Society, the accompanying statements arranged principally from materials which I collected in the year 1813-14, while in charge of the office of judge and magistrate of the district of *Burdwan*.

The document, marked No. 1, exhibits an abstract statement of the population of 98 towns and villages situated in some of the western districts of *Bengal*, procured with the view of ascertaining the general average proportion of inhabitants to each dwelling.

The document, marked No. 2, contains an abstract statement of the total number of dwelling-houses respectively inhabited by *Hindús* and *Mahomedans* in the

district of *Burdwan*, arranged under the head of the several police jurisdictions.

The paper, marked No. 3, exhibits an abstract classification of the *Hindú* inhabitants of 26 villages in the district of *Burdwan*, arranged under their respective castes or professions.

The paper, marked No. 4, exhibits the average price of some articles of common consumption in the town of *Calcutta*, in each year from 1753 to 1814.

The papers, respectively numbered 5, 6, and 7, contain statements of the average price of rice and some other articles of consumption in each year from 1783 to 1814, at the towns of *Súrúl* and *Elambazar*, in the district of *Bírbhúm*, and at the town of *Mancaur*, in the district of *Burdwan*.

I proceed to offer such remarks, in explanation of each of the annexed statements, as appear necessary.

No. 1. The detailed enumerations, from which this paper is formed, were obtained partly through the agency of some respectable native proprietors of estates with whom I was personally acquainted, and partly by the aid and influence of *European* gentlemen residing in the several districts, from which the returns have been furnished.

I have reason to be satisfied that few of these returns are inaccurate, and none of them materially so. The towns and villages included in this paper are situated in various parts of the districts of *Burdwan*, *Húghli*. *Midnapúr*, *Bírbhúm*, and the *Jungle Mehàls*. They differ in their size, opulence, and other circumstances; some of them are market-towns or places of established manufactures; some are principally inhabited by *Hindús*, and

others by *Mahomedans;* some are heavily assessed, others again are nearly rent-free.

Under these circumstances an accurate average of the proportion of inhabitants to each dwelling, throughout the district of *Burdwan*, may be deduced from the annexed abstract; and as there exists no very material difference in the state of society, the same average may probably be considered to be generally applicable throughout *Bengal.*

It is scarcely necessary to observe that many dwellings, especially those of the more opulent classes of inhabitants, include several distinct buildings, huts, or out-offices within one enclosure; and frequently contain distinct families of several brothers or other near relations. A dwelling of this description, whatever may be the number of buildings included in it, is intentionally considered and rated as one dwelling, both in this statement and in that marked No. 2, exhibiting the total number of dwelling-houses in the district of *Burdwan.* With reference to these circumstances, the proportion of 5½ inhabitants to a house, resulting from the general average of the paper marked No. 1, appears smaller than might have been reasonably expected, and is, in fact, less than the average proportion of inhabitants to each house in *England.*

The number of males appears from the statement to be somewhat greater than that of the females, being 82,285 of the former, to 81,149 of the latter. The population returns of other countries generally exhibit a larger number of females than of males; in *England,* however, if the males employed in the army and navy be included, the sexes are very nearly equal in number.

No. 2. The statement, marked No. 1, having furnished me with the average proportion of inhabitants to each dwelling, I proceeded to ascertain the actual number of dwelling-houses in the district of *Burdwan,* distinguish-

ing them as occupied by *Hindús* and *Mahomedans* respectively.

The proprietors of every *mauza* or village in the district, or their resident agents, were furnished through the police officers of each division with a form in the *Bengalí* language, intended to shew the name of the village, of the *pergannah*, and of the police jurisdiction, the total number of dwelling-houses in each village, and the number occupied by *Hindús* and *Mahomedans* respectively.

Such instructions and explanations were at the same time furnished as appeared necessary to prevent mistakes and omissions, and to remove all grounds of suspicion and jealousy on the part of the inhabitants. The proprietors, farmers, or their resident agents were directed to supply the information required, and to insert it in the form with every possible attention to accuracy. The statements, after being so prepared, were attested by the proprietor or his agent, and by some of the *mendels* or most respectable inhabitants of each village; and were then delivered to the police officers of the jurisdiction, by whom they were arranged alphabetically under the head of each *pergannah*.

I believe that the returns have been generally prepared with due care and accuracy; and I met with no instance of reluctance, on the part of the proprietors or their agents, in communicating the information required.

According to the statements so furnished, the district of *Burdwan* contains 262,634 dwelling-houses, of which 218,853 are occupied by *Hindús*, and 43,781 by *Mahomedans*; allowing $5\frac{1}{2}$ inhabitants to each dwelling, the total population of *Burdwan* will amount to 1,444,487 souls. The area of the district of *Burdwan*, as its boundaries are at present arranged, comprises about 2,400 *English* square miles. On an average, therefore,

each square mile contains a population of more than 600 persons.

The total population of *England* gives an average of near 200 inhabitants to each square mile; but if some particular counties are selected, the proportion will be found to approximate much more nearly to that of *Burdwan.* The county of *Lancaster*, for instance, contains about 1,800 square miles, and its population in the year 1811 amounted to 856,000, furnishing an average of 476 inhabitants to a square mile.

It should be observed, however, that the district of *Burdwan* is one of the most productive and highly cultivated portions of the *British* territories in *India*, and that it contains scarcely any *jungle* or waste land.

The materials, from which I have calculated the population of the district of *Burdwan*, appear to be sufficiently solid and accurate for every practical purpose; and I am satisfied that the total population of *British India* and the proportion of *Hindú* to *Mahomedan* inhabitants might be ascertained in a similar manner with little difficulty or inconvenience.

The result of such a general inquiry, conducted on uniform principles, would not merely be gratifying to public curiosity, but might eventually prove of great practical importance in the improvement of the police, and in the general administration of the extensive territories subject to the *British* government in *India.*

No. 3. This statement exhibits the total *Hindú* population of 26 villages in the district of *Burdwan*; the inhabitants are classed under the heads of their respective castes or professions, and according to their ages; the males as being above or below 16 years of age, the females as above or below 12 years of age; the villages,

from which this abstract was formed, were selected in preference to others as containing more than the usual proportion of *Hindú* inhabitants; the statement shews almost all the classes and professions into which the *Hindú* population is generally divided in the western parts of *Bengal*, but it cannot be considered to furnish any accurate average of the proportions which the different classes bear to each other: it may be remarked that the proportion of females to males is generally larger in the higher classes, while in the lower classes the males are more numerous than the females.

No. 4. This statement has been prepared from accounts preserved in a respectable *Hindú* family in *Calcutta*. The average is deduced from the sum total annually expended in the purchase of each article for the ordinary consumption of that family, compared with the total quantity of each article purchased within each year.

No. 5. I am indebted for this document to Mr. CHEAP, the commercial resident at *Súrúl*; it contains the current prices of coarse and fine rice, of salt, oil, ghee, molasses, and turmeric, in the month of *Pús*, during the last 30 years at the town of *Súrúl*.

No. 6. The accuracy of this statement, which was obligingly furnished to me by Mr. ERSKINE, a gentleman residing at *Elambazár*, in the district of *Bírbhúm*, may be relied upon. The difference in the price of rice, in the respective months of *Pús* and *A'sárh* of each year, is worthy of observation: a similar variation of price at those periods is general throughout the interior of the western districts of *Bengal*, and is a source of abundant profit to the more opulent *mahajans* or speculators in that article, and of considerable injury to the indigent classes of cultivators: these last are generally in debt to the village *mahajans*; they procure rice for seed and for the consumption of their families, either by a ruinous

mortgage of the ensuing crop, or at an exorbitant rate of interest in the month of *A'sárh*, a period when the price is almost uniformly higher than at any other period. In *Pús*, when the principal harvest is gathered, they are under the necessity of immediately disposing of the produce of their fields, to enable them to discharge the heavy instalments of their rent which then become due. They have neither resources sufficient to dispose of the grain at a distant market, nor to postpone the sale until a more favourable period. They are thus compelled to throw nearly the whole produce of the village into a confined market at the same time, and the only purchasers are the *mahajans* of the village, who are thus able to fix the rates almost at their own discretion. This evil is of course less felt in the neighbourhood of navigable rivers, (*Elambazár* is on the banks of the *Adjy,*) and in the vicinity of large towns; and the price in *Calcutta* does not essentially vary at those seasons which, in the interior of the country, are respectively the cheapest or dearest periods.

No. 7. I procured this document from a respectable grain merchant residing at the town of *Máncaur*, in the district of *Burdwan*. From the inquiries, which I had an opportunity of making on the spot, I have reason to believe that it is prepared with perfect accuracy.

From the Papers marked Nos. 4, 5, 6, 7, it may be observed that the period of ten years, from 1793 to 1803, was generally a cheaper period than the ten years preceding or following it; and that the price of rice, and generally of other articles, has not experienced any very material or permanent augmentation from the year 1761 to the present time.

I have the honour to be,

SIR,

Your most obedient humble Servant,

W. B. BAYLEY.

CALCUTTA,
17th September 1814.

No. 1. Returns of the population of ninety-eight villages and towns, situated in the western parts of *Bengal*; procured with the view of ascertaining the general average proportion of inhabitants to a dwelling.

No. 2. Statement of the total number of dwelling-houses respectively inhabited by *Hindús* and *Múselmans* in the district of *Burdwan*, arranged under the head of the several police jurisdictions.

No. 3. Abstract classification of the whole number of *Hindú* inhabitants in twenty-six villages of *Burdwan*, arranged under the heads of their respective castes or professions.

No. 4. Annual average price of some articles of common consumption in the town of *Calcutta* in each year, from 1753 to 1814.

No. 5. Average price of articles of general consumption at *Súrúl*, from 1783 to 1813.

No. 6. Average price of fine and coarse rice at *Elambazár*, from 1783 to 1813.

No. 7. Wholesale price of coarse rice in *Pús* at *Máncaur*, in zillah *Burdwan*, from 1783 to 1813.

No. I.

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male Inhabitants	Number of Female Inhabitants	Total Population Male and Female.	Proportion of Inhabitants to a House.
1st.	Gopál Nagar	Zillah Burdwan ..	8	19	21	40	5
	Jamál Mát	.... Ditto	11	30	32	62	$5\frac{1}{2}$
	Bedchala..............	.... Ditto	13	36	32	68	$5\frac{1}{4}$
	Bhagwánpúr	.... Ditto	15	37	37	74	5
	Camal Nagar	.... Ditto	17	46	50	96	$5\frac{1}{3}$
	Cáncáta	Jungle Mehals....	20	78	75	153	$7\frac{1}{3}$
	Mat'hurapúr	Zillah Burdwan ..	21	0	0	137	$6\frac{1}{2}$
	Defferpúr	.... Ditto	24	70	58	128	$5\frac{1}{3}$
	Bamúnpúr	.... Ditto	26	61	74	135	$5\frac{1}{5}$
	Múlra	.... Ditto	27	74	69	143	$5\frac{1}{4}$
	Asápúr	.... Ditto	28	88	73	161	$5\frac{3}{4}$
	Máncunda	Zillah Bírbhúm ..	29	0	0	152	$5\frac{1}{4}$
	Rádháramanpúr	Zillah Burdwan ..	30	73	76	149	5
	Hershapúr	.... Ditto ..	31	0	0	180	6 nearly
	Total of 14 Villages.		300	612	597	1,678	$5\frac{1}{2}$

No. I.—(*continued*).

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male Inhabitants	Number of Female Inhabitants	Total Population Male and Female.	Proportion of Inhabitants to a House.
2d.	Morádpúr	Zillah Burdwan ..	32	0	0	229	$7\frac{1}{6}$
	Gopicant'hpúr..........	.... Ditto	34	101	88	189	$5\frac{1}{2}$
	Nagargáchi............	.... Ditto	37	97	94	191	$5\frac{1}{6}$
	Dhunai	.... Ditto	39	110	104	214	$5\frac{3}{5}$
	Bijípúr	.... Ditto	41	118	106	224	6
	Däemnagar............	.... Ditto	42	150	146	296	7
	Ak'hulíya	.... Ditto	43	122	107	229	$5\frac{1}{8}$
	Kaïmnagar	.... Ditto	44	122	125	247	$5\frac{3}{5}$
	Bhásapúr	.... Ditto	46	109	113	222	5 not.
	Rámbáti	Zillah Bírbhúm ..	47	0	0	305	$6\frac{1}{4}$
	Mohabetgerh	Zillah Burdwan ..	48	112	114	226	$4\frac{2}{3}$
	Pátpúr................	Jungle Mehals ..	49	133	131	264	$5\frac{1}{3}$
	Palasan	Zillah Burdwan ..	50	146	117	263	$5\frac{1}{4}$
	Náranga	Zillah Húgli	53	131	138	269	5
	Total of 14 Villages		605	1,451	1,383	3,368	$5\frac{1}{2}$

No. I.—*(continued)*.

NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male Inhabitants	Number of Female Inhabitants	Total Population Male and Female.	Proportion of Inhabitants to a House.
3d. Cútruci	Zillah Burdwan ..	55	204	206	410	$7\frac{1}{2}$
Babuishol	.... Ditto	56	157	143	300	$5\frac{1}{3}$
Baggiepúr	Zillah Bírbhúm ..	59	0	0	322	$5\frac{1}{2}$
Jhijra	Zillah Burdwan ..	60	172	145	317	$5\frac{1}{4}$
Rám-crishenpúr	.... Ditto	60	0	0	423	7
Rádhácrishenbátí	.... Ditto	63	181	169	350	$5\frac{1}{2}$
Gérh Simlapol	Midnapúr	65	179	168	347	$5\frac{1}{3}$
Dépúr	.... Ditto	66	184	163	347	$5\frac{1}{4}$
Mank'hóta	.... Ditto	67	175	177	352	$5\frac{1}{4}$
Abudanga	Zillah Bírbhúm ..	68	0	0	331	5
Bhagwánpúr	Zillah Burdwan ..	69	178	166	344	5
Bámania	.... Ditto	69	164	185	349	5
Berdaba	.... Ditto	70	157	169	326	$4\frac{2}{3}$
S'rigaon	.... Ditto ...	73	201	177	378	$5\frac{1}{5}$
Total of 14 Villages.		900	1,952	1,868	4,896	$5\frac{1}{2}$

No. I.—(*continued*).

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male Inhabitants	Number of Female Inhabitants	Total Population Male and Female.	Proportion of Inhabitants to a House.
4th.	Bhagwánpúr	Zillah Burdwan ..	78	283	266	549	$6\frac{4}{5}$
	Dubrájpúr	Jungle Mehals ..	79	229	212	451	$5\frac{2}{3}$
	Shicarpúr	Zillah Burdwan ..	84	275	234	509	6
	Gangadáspúr	Zillah Húgli	84	0	0	667	$7\frac{3}{4}$
	Barícha	Zillah Midnapúr	91	300	335	635	7
	Baricrishenpúr	Zillah Burdwan ..	93	231	222	453	5 nearly.
	Gawáltor..............	Zillah Midnapúr..	113	295	278	573	5 above.
	Dháncáror	Zillah Burdwan ..	120	315	356	671	$5\frac{3}{5}$
	Nandgäon	.... Ditto	128	318	350	668	5
	Sultanpúr	.... Ditto	129	345	352	697	$5\frac{2}{5}$
	Angaríya..............	.... Ditto	136	411	420	831	6
	Ramcrishenpúr	.... Ditto	140	362	327	689	5 not quite.
	Sudersanpúr	.... Ditto	143	426	382	808	$5\frac{2}{3}$
	Mohanpúr	.... Ditto	147	376	383	759	5
	Total of 14 Villages.		1,565	4,176	4,117	8,960	$5\frac{3}{4}$

No. I.—*(continued)*.

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male Inhabitants	Number of Female Inhabitants	Total Population Male and Female.	Proportion of Inhabitants to a House.
5th.	Caraunda	Zillah Burdwan ..	153	406	359	765	5
	Alifnagar...............	.... Ditto	154	478	484	962	$6\frac{1}{4}$
	Hírangaön	.... Ditto	164	440	400	840	$5\frac{1}{8}$
	Rámes'warpúr..........	.... Ditto	171	445	457	902	$5\frac{1}{4}$
	Gopinát'h Báti	.... Ditto	178	465	505	970	$5\frac{1}{2}$
	C'handárí	.... Ditto	187	634	695	1,329	$6\frac{1}{2}$
	Jamtárá	.... Ditto	187	446	457	903	$4\frac{5}{6}$
	Crishennagar	Zillah Midnapúr..	200	484	516	1,000	5
	U'ch'hgaön	Zillah Burdwan ..	204	514	494	1,008	5
	Bersúl	.... Ditto	209	664	607	1,271	6
	Jhícra	Jungle Mehals ..	216	691	517	1,308	6 and above.
	Rascúnd	Zillah Midnapúr..	218	560	652	1,112	5 above.
	Gítgaön	Zillah Burdwan ..	253	686	620	1,306	$5\frac{1}{5}$
	Savantí	.... Ditto	257	827	777	1,604	$6\frac{1}{5}$
	Total of 14 Villages.		2,751	7,740	7,540	15,280	$5\frac{1}{2}$

No. I.—(*continued*).

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male Inhabitants	Number of Female Inhabitants	Total Population Male and Female.	Proportion of Inhabitants to a House.
6th.	Daroghapára	Zillah Burdwan	267	698	709	1,407	$5\frac{1}{4}$
	Betagerh	Zillah Midnapúr	284	738	764	1,502	$5\frac{1}{3}$
	Iral	Zillah Burdwan	310	844	859	1,703	$5\frac{1}{2}$
	Deriyapúr	Ditto	319	778	789	1,567	5 nearly.
	Súdpúr	Ditto	323	872	887	1,759	$5\frac{1}{2}$ nearly.
	Caití	Ditto	338	1,051	900	1,951	$5\frac{2}{3}$
	Rájgaon	Jungle Mehals	342	1,134	1,142	2,276	$6\frac{2}{3}$
	Bedengunj	Zillah Midnapúr	365	1,220	1,186	2,406	$6\frac{2}{3}$
	Cayapat	Ditto	389	1,112	1,154	2,266	6 nearly.
	Amaragerh	Zillah Burdwan	415	1,088	1,067	2,155	$5\frac{1}{5}$
	Satgachia	Ditto	422	1,482	1,516	2,998	$7\frac{1}{10}$
	Sencarí	Ditto	443	1,178	1,143	2,321	$5\frac{1}{4}$
	Palási	Ditto	448	1,108	1,187	2,295	$5\frac{1}{4}$
	Maro	Ditto	474	1,272	1,100	2,372	5
	Total of 14 Villages.		5,139	14,575	14,403	28,978	$5\frac{2}{3}$

No. I.—(*continued*).

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male Inhabitants	Number of Female Inhabitants	Total Population Male and Female.	Proportion of Inhabitants to a House.
7th.	Khajuanwer	Zillah Burdwan ..	496	1,466	1,528	2,994	6 and upwards.
	Bancada	.... Ditto	501	1,251	1,195	2,446	5 near.
	Carúi	.... Ditto	581	1,387	1,358	2,745	$5\frac{1}{4}$
	Mendelgaön	.... Ditto	524	1,273	1,218	2,491	5 nearly.
	Elambazár	Zillah Bírbhúm ..	544	1,463	1,487	2,950	$5\frac{2}{5}$
	Bijar	Zillah Burdwan ..	610	1,618	1,745	3,363	$5\frac{1}{2}$
	Bhalcí	.... Ditto	656	1,640	1,680	3,320	5 above.
	C'handghós	.... Ditto	744	1,892	1,826	3,718	5 nearly.
	Dignagér	.... Ditto	941	2,493	2,456	4,949	$5\frac{1}{4}$
	Bainchí	Zillah Huglí	1,074	2,930	2,910	5,840	$5\frac{1}{2}$
	Mancaur and its suburbs ..	Zillah Burdwan ..	1,562	4,417	4,265	8,682	$5\frac{1}{2}$
	Keerpoy	Zillah Huglí	1,776	0	0	10,525	6 near.
	Chandercona	.... Ditto	2,836	9,120	9,025	18,145	$6\frac{2}{5}$
	Chandernagar	French settlement	8,484	20,829	20,548	41,377	5 near.
	Total of 14 Villages.		21,266	51,779	51,241	1,13,545	$5\frac{1}{3}$

ABSTRACT OF THE PRECEDING TABLES.

NUMBER OF TABLE.	Total Number of Houses.	Total Number of Male Inhabitants.	Total Number of Female Inhabitants.	Total Population, Male and Female.	Average Proportion of Inhabitants.
1st................	300	612	597	1,678	$5\frac{1}{2}$
2d................	605	1,451	1,383	3,368	$5\frac{1}{2}$
3d................	900	1,952	1,868	4,896	$5\frac{1}{2}$
4th	1,565	4,176	4,117	8,960	$5\frac{3}{4}$
5th	2,751	7,740	7,540	15,280	$5\frac{1}{2}$
6th	5,139	14,575	14,403	28,978	$5\frac{2}{3}$
7th	21,266	51,779	51,241	1,13,545	$5\frac{1}{3}$
Total of 98 Towns and Villages ..	32,526	82,285	81,149	1,76,705	$5\frac{1}{2}$ nearly.

No. II.

STATEMENT of the Total Number of Dwelling-Houses respectively inhabited by *Hindús* and *Múselmans,* in the District of *Burdwan*, arranged under the Head of the several Police Jurisdiction.

Number of Thannas.	THANNAS.	Total of Mauzas.	Total of Houses.	Total of Houses inhabited by Hindús.	Total of Houses inhabited by Múselmans.
1	Catwa	230	20,790	18,688	2,102
2	Cait'hí	157	13,046	9,923	3,123
3	Chand Ghós	220	14,548	11,770	2,778
4	Banpas	92	11,554	10,096	1,458
5	Balcrishen	115	9,218	7,528	1,690
6	Cúchat	310	22,847	19,786	3,061
7	Mengelcót	235	19,331	15,954	3,377
8	Calna	336	24,811	20,817	3,994
9	Sondah	121	10,934	8,978	1,956
10	Salímabad	458	29,341	23,188	6,153
11	Pubet'hal	265	15,033	12,671	2,362
12	Dignager........	145	19,814	17,533	2,281
13	Somander Gher ..	160	8,239	6,049	2,190
14	Bersúl	110	8,981	6,895	2,086
15	Town of Burdwan and suburbs ..	72	9,805	7,651	2,154
16	Cútalpúr	470	24,342	21,326	3,016
	Total ..	3,496	2,62,634	2,18,853	43,781

On an average each police jurisdiction contains about 218 mauzas. Each mauza about 75 houses, each house contains about $5\frac{1}{2}$ inhabitants. The proportion of *Hindús* to *Mahometans* is as 5 of the former to 1 of the latter, and of males to females about 100 of the former to $98\frac{2}{}$th of the latter. The total number of inhabitants in the district, at the average of $5\frac{1}{2}$ to each house will be 1,444,487. The jurisdiction of this zillah includes an area of about 2,400 square miles, and the proportion of inhabitants to a square mile is more than 600.

No. III.

ABSTRACT Classification of the whole Number of *Hindú* Inhabitants in 26 Villages of *Burdwan*, arranged under the Heads of their respective Castes or Professions.

CASTES.		Number of Houses.	Males above 16 Years.	Females above 12 Years.	Males below 16 Years.	Females below 12 Years.	Total Number of Inhabitants.	Proportion of Inhabitants to a House.
Brahmans		1,297	2,356	2,738	1,266	947	7,307	$5\frac{1}{3}$
Cshettries		5	10	10	5	2	27	$5\frac{1}{2}$
Rajpúts		69	121	151	53	47	372	$5\frac{2}{5}$
Vaidyas	Physicians	17	42	42	26	14	124	$7\frac{1}{3}$
Káyesthas	Scribes	408	701	839	421	288	2,249	$5\frac{1}{2}$
Gandh-Banias	Druggists	283	500	581	260	191	1,532	$5\frac{1}{3}$
Cansáris	Braziers	25	58	65	31	22	176	7
Sáncáris	Shell ornament makers	12	16	16	12	6	50	$4\frac{1}{6}$
Aguris	Farmers	557	981	1,113	538	359	2,991	$5\frac{1}{3}$
Málacárs	Florists	20	36	40	16	12	104	$5\frac{1}{5}$
Napits	Barbers	128	221	243	131	115	710	$5\frac{1}{2}$
Cumars	Potters	85	159	181	71	53	464	$5\frac{1}{2}$
Mairas	Confectioners	108	162	199	78	50	489	$4\frac{1}{2}$
Tantis	Weavers	149	271	265	142	77	755	5
Carmacars	Blacksmiths	167	258	339	145	97	839	5
Barrooes	Paun-sellers	2	4	5	5	2	16	8
Tambulis	Venders of betel leaf	99	161	193	83	74	511	$5\frac{1}{6}$
Sat-Gopis	Cultivators	826	1,463	1,630	854	547	4,494	$5\frac{1}{2}$
Gwalas	Herdsmen	352	623	680	333	221	1,857	$5\frac{1}{2}$
Baishnavas	Religious mendicants, or Priests	139	175	197	88	58	518	$3\frac{2}{3}$
Mohants		3	3	7	1	3	14	$4\frac{2}{3}$
Bhats	Encomiasts	42	63	80	41	28	212	5
Panc'hias	A class of beggars	4	4	6	3	1	14	$3\frac{1}{2}$
Daibajnyas	Astrologers	42	74	86	46	18	224	$5\frac{1}{3}$
Kayebartas	Cultivators	50	90	100	43	31	264	$5\frac{1}{3}$
Sonarbanias	Bankers or money changers	61	120	137	62	38	357	$5\frac{7}{8}$
Swernacars	Goldsmiths	63	132	143	62	53	390	$6\frac{1}{5}$
Téllíyas	Oilmen	250	427	512	224	136	1,299	$5\frac{1}{5}$
Calus	Oilmen	158	276	322	145	134	877	$5\frac{1}{2}$
Jellias	Fishermen	55	98	99	57	34	288	$5\frac{1}{4}$
Chutárs	Carpenters	81	135	147	64	43	389	$4\frac{2}{3}$
Dhobahs	Washermen	44	77	86	41	24	228	$5\frac{1}{5}$
Jugís	Weavers	15	36	36	15	12	99	$6\frac{1}{2}$
Bayutes	Mat-makers	19	32	31	21	15	99	$5\frac{1}{5}$
Sarat'hís	Carters	14	22	27	12	14	75	$5\frac{1}{3}$
Chunarias	Lime-burners	12	17	61	7	1	41	$3\frac{1}{2}$
Lohars	Porters, Labourers, Cultivators, Boatmen, Sweepers, Watchmen, Palankeen carriers, Fishermen, &c. &c.	9	16	20	3	4	43	$4\frac{2}{3}$
Bawuris		197	262	306	248	175	991	5
Cotals		263	435	476	216	142	1,269	$4\frac{7}{8}$
Haris		109	203	215	118	77	613	$5\frac{1}{2}$
Bagdís		841	1,205	1,384	858	641	4,088	$4\frac{7}{8}$
Dulias		57	90	113	50	36	289	5
Malls	Snake-catchers	5	6	6	7	3	22	$4\frac{1}{2}$
Chandalls	As Cotals	39	53	58	18	22	145	$3\frac{2}{3}$
Domes	Basket-makers	201	285	321	254	174	1,034	$5\frac{2}{3}$
Súrís	Distillers	137	236	305	111	63	765	5^2
Muchis	Curriers	86	158	165	97	104	524	6
	Total	7,605	12,922	14,796	7,332	5,208	40,238	$5\frac{1}{3}$

No. IV.

ANNUAL Average Price of the following Articles of common Consumption in the Town of *Calcutta*, in each Year from 1753 to 1814.

	Bengal Style.	A. D.	Rice coars 80 Sa. Wt. per Seer: per Rupee.			Oil 80 Sa. Wt. per Seer: per Rupee.			Ghee 80 Sa. Wt. per Seer: per Rupee.			Goor 80 Sa. Wt. per Seer: per Rupee.		
			Mds.	Srs.	Chts.	Mds.	Srs.	Chts.	Mds.	Srs.	Chts.	Mds.	Srs.	Chts.
	1160	1753-4	1	15	0	0	11	8	0	3	12	0	20	0
	1161	1754-5	1	12	0	0	12	0	0	3	12	0	20	0
	1162	1755-6	1	14	0	0	11	10	0	3	12	0	18	0
	1163	1756 7	1	6	0	0	12	0	0	3	8	0	16	0
	1164	1757-8	1	15	0	0	10	8	0	3	0	0	18	0
	1165	1758-9	1	7	0	0	10	8	0	3	12	0	16	0
	1166	1759-60	1	15	0	0	12	0	0	4	8	0	12	0
	1167	1 0-1	1	2	0	0	8	8	0	4	0	0	14	0
	1168	1761-2	0	31	0	0	6	12	0	3	0	0	18	0
	1169	1762-3	0	31	0	0	6	0	0	2	4	0	18	0
Total of 10 Years........			11	28	0	2	1	6	0	35	4	4	10	0
Or on an average per annum			1	6	12	0	10	2	0	3	8	0	17	0
	1170	1763-4	0	35	0	0	8	0	0	3	4	0	15	0
	1171	1764-5	0	30	0	0	6	0	0	3	0	0	15	0
	1172	1765-6	1	6	0	0	7	0	0	3	8	0	18	0
	1173	1766-7	1	5	0	0	8	0	0	3	0	0	16	0
	1174	1767-8	1	5	0	0	8	0	0	2	12	0	16	0
	1175	1768-9	1	0	0	0	7	0	0	2	12	0	16	0
	1176	1769-70	1	12	0	0	7	0	0	3	8	0	17	0
	1177	1770-1	0	12	0	0	8	8	0	3	0	0	10	0
	1178	1771-2	0	28	0	0	4	8	0	3	8	0	16	0
	1179	1772-3	0	30	0	0	6	4	0	3	0	0	16	0
Total of 10 Years........			9	3	0	1	30	4	0	31	4	3	35	0
Or on an average per annum			0	36	4	0	7	0	0	3	2	0	15	8 0
	1180	1773-4	0	31	0	0	6	0	0	2	4	0	18	0
	1181	1774-5	1	0	0	0	5	0	0	3	0	0	16	0
	1182	1775-6	0	35	0	0	8	4	0	2	12	0	17	0
	1183	1776-7	0	37	0	0	7	12	0	3	0	0	16	0
	1184	1777-8	0	39	0	0	5	12	0	4	8	0	16	0
	1185	1778-9	0	25	0	0	5	0	0	2	10	0	13	0
	1186	1779 8	0	34	0	0	5	8	0	2	6	0	16	0
	1187	1780-1	0	35	0	0	8	0	0	2	8	0	17	0
	1188	1781-2	1	0	0	0	7	12	0	2	14	0	17	0
	1189	1782-3	1	5	0	0	4	12	0	2	10	0	16	0
Total of 10 Years........			9	1	0	1	23	12	0	28	8	4	2	0
Or on an average per annum			0	36	1	0	6	6	0	2	13	0	16	3

No. IV.—(*continued*).

	Bengal Style.	A. D.	Rice coarse 80 Sa. Wt. per Seer: per Rupee.			Oil 80 Sa. Wt. per Seer: per Rupee.			Ghee 80 Sa. Wt. per Seer: per Rupee.			Goor 80 Sa. Wt. per Seer: per Rupee.		
			Mds.	Srs.	Chts.	Mds.	Srs.	Chts.	Mds.	Srs.	Chts.	Mds.	Srs.	Chts.
	1190	1783-4	0	36	0	0	6	10	0	3	0	0	18	0
	1191	1784-5	0	26	0	0	6	4	0	3	4	0	16	0
	1192	1785-6	1	2	0	0	7	6	0	3	12	0	16	0
	1193	1786-7	1	1	0	0	8	0	0	3	10	0	16	0
	1104	1787-8	0	20	0	0	7	0	0	2	0	0	12	0
	1195	1788-9	0	32	0	0	6	8	0	2	8	0	14	0
	1196	1789-10	0	32	0	0	6	12	0	2	12	0	13	0
	1197	1790-1	0	34	0	0	7	0	0	2	12	0	16	0
	1198	1791-2	0	30	0	0	5	0	0	3	0	0	16	0
	1199	1792-3	0	24	0	0	6	0	0	3	2	0	17	0
Total of 10 Years........			7	37	0	1	26	8	0	29	12	3	34	0
Or on an average per annum			0	31	11	0	6	10	0	2	15	0	15	6
	1200	1793-4	0	36	0	0	5	8	0	3	4	0	16	0
	1201	1794-5	1	0	0	0	6	8	0	2	8	0	14	0
	1202	1795-6	0	39	0	0	5	0	0	2	8	0	14	0
	1203	1796-7	1	2	0	0	6	0	0	2	4	0	13	0
	1204	1797-8	0	35	0	0	5	12	0	2	12	0	14	0
	1205	1798-9	0	36	0	0	5	0	0	2	0	0	13	0
	1206	1799-18	0	32	0	0	5	8	0	2	8	0	13	0
	1207	1800-1	0	37	0	0	6	8	0	2	4	0	13	0
	1208	1301-2	0	35	0	0	7	0	0	2	0	0	12	0
	1209	1802-3	0	37	8	0	3	6	0	2	4	0	13	0
Total of 10 Years........			9	9	8	1	16	2	0	24	4	3	15	0
Or on an average per annum			0	36	15	0	5	9	0	2	6	0	13	8
	1210	1803-4	0	35	0	0	5	0	0	2	0	0	13	0
	1211	1804-5	0	30	0	0	8	0	0	2	4	0	13	4
	1212	1805-6	0	35	0	0	7	0	0	2	12	0	14	0
	1213	1806-7	0	37	0	0	5	8	0	2	10	0	13	0
	1214	1807-8	0	25	0	0	4	12	0	2	0	0	14	0
	1215	1808-9	0	35	0	0	4	8	0	2	2	0	14	0
	1216	1809-10	1	3	0	0	5	4	0	2	0	0	15	0
	1217	1810-11	0	30	0	0	4	12	0	2	0	0	13	0
	1218	1811-12	1	4	0	0	5	0	0	2	0	0	13	0
	1219	1812-13	0	31	0	0	5	12	0	2	0	0	13	0
	1220	1813-14	0	34	0	0	5	12	0	2	0	0	13	0
	1221	1814-15	1	0	0	0	9	8	0	2	8	0	13	0
Total of 10 Years........			10	19	0	1	30	12	0	26	4	4	1	4
Or on an average per annum			0	34	14	0	5	14	0	2	3	0	13	7

No. V.

AVERAGE Price of Articles of General Consumption at *Súrúl.*

	Bengal Style.	A. D.	RICE. FINE. Prices in Pus, weight 73-4 Sa. Wt. per Rupee.			RICE. COARSE. Prices in Pus, per Rupee.			Salt 58-10 Sa. Wt. per Seer. Seers per Rupee.			Oil ditto, Seers per Rupee.			Ghee ditto, price per Maund.			Goor as usual in Pus; Seers of about 22 Seers to a Maund of 58-10.			Haldi per Maund of 58-10 Sa. Wt. per Seer.		
			Mds.	Srs.	Chts	Mds.	Srs.	Chts	Mds.	Srs.	Chts	Mds.	Srs.	Chts	Rs.	As.	Gs.	Mds.	Srs.	Chts	Rs.	As.	Gs.
	1190	1783-4	0	23	8	0	29	2	0	15	0	0	7	0	11	7	0	0	17	0	2	3	11
	1191	1784-5	1	10	6	1	15	5	0	14	0	0	8	6	10	0	0	0	16	0	2	1	14
	1192	1785-6	1	31	10	1	37	4	0	17	0	0	7	0	10	10	0	0	17	0	2	5	13
	1193	1786-7	1	10	6	1	15	14	0	16	0	0	8	6	10	0	0	0	18	0	2	6	16
	1194	1787-8	1	6	3	1	12	4	0	14	0	0	8	6	10	0	0	0	17	0	2	1	14
	1195	1788-9	0	31	6	0	36	15	0	15	0	0	10	7	9	6	10	0	16	0	2	0	0
	1196	1789-10	1	20	7	1	26	1	0	16	0	0	8	6	10	10	10	0	18	0	2	6	16
	1197	1790-1	1	36	2	1	38	11	0	17	0	0	8	0	10	0	0	0	20	0	2	0	0
	1198	1791-2	0	25	13	0	31	5	0	14	0	0	8	6	11	7	0	0	15	0	1	14	10
	1199	1792-3	1	20	7	1	26	1	0	14	0	0	10	13	10	10	10	0	14	0	1	13	2
Total of 10 Years............			12	16	4	13	28	14	3	32	0	2	5	2	104	4	0	4	8	0	21	5	16
Ditto calculated at 80 Sa. Wt. per Seer...............			11	14	6	12	22	11	2	31	7	1	22	7	142	3	0	3	3	2	29	2	10
Or on an average per annum..			1	5	7	1	10	4	0	11	2	0	6	4	14	3	10	0	12	5	2	14	13

No. V.—(*continued*).

	Bengal Style.	A. D.	RICE. FINE. Prices in Pus, weight 73-4 Sa. Wt. per Rupee.			RICE. COARSE. Prices in Pus, per Rupee.			Salt 58-10 Sa. Wt. per Seer. Seers per Rupee.			Oil ditto, Seers per Rupee.			Ghee ditto, price per Maund.			Goor as usual in Pus, Seers of about 22 Seers to a Maund of 58-10.			Haldi per Maund of 58-10 Sa. Wt. per Seer.		
			Mds.	Srs.	Chts	Mds.	Srs.	Chts	Mds.	Srs.	Chts	Mds.	Srs.	Chts	Rs.	As.	Gs.	Mds.	Srs.	Chts	Rs.	As.	Gs.
	1200	1793-4	1	12	10	1	18	2	0	16	0	0	8	6	10	0	0	0	20	0	2	8	0
	1201	1794-5	2	4	8	2	10	1	0	15	0	0	9	12	11	7	0	0	9	0	2	3	11
	1202	1795-6	1	21	9	1	27	2	0	14	0	0	10	11	9	6	10	0	13	0	2	9	5
	1203	1796-7	1	32	12	2	3	15	0	16	0	0	10	13	10	0	0	0	20	0	1	9	12
	1204	1797-8	1	32	12	1	36	2	0	16	0	0	9	12	10	0	0	0	18	0	1	6	17
	1205	1798-9	2	11	12	2	17	6	0	18	0	0	10	13	16	10	10	0	27	0	2	1	14
	1206	1799-10	1	27	2	1	32	12	0	16	0	0	13	10	10	0	0	0	21	0	2	0	0
	1207	1800-1	1	10	6	1	38	5	0	16	0	0	14	0	10	0	0	0	20	0	1	13	2
	1208	1801-2	1	31	10	1	36	2	0	16	0	0	12	9	8	15	0	0	19	0	1	13	10
	1209	1802-3	1	21	9	1	27	2	0	16	0	0	9	12	8	15	0	0	19	0	1	13	2
Total of 10 Years...........			17	6	10	19	7	1	3	39	0	2	30	8	99	6	0	5	1	0	19	15	13
Ditto calculated at 80 Sa. Wt. per Seer................			15	28	12	17	22	.6	2	36	10	2	1	2	135	10	0	3	27	5	27	4	5
Or on an average per annum..			1	22	14	1	30	3	0	11	11	0	8	0	13	9	0	0	14	11	2	11	16

No. V.—(*continued*).

	Bengal Style.	A. D.	RICE. FINE. Prices in Pus, weight 73-4 Sa. Wt. per Rupee.			RICE. COARSE. Prices in Pus, per Rupee.			Salt 58-10 Sa. Wt. per Seer. Seers per Rupee.			Oil ditto, Seers per Rupee.			Ghee ditto, price per Maund.			Goor as usual in Pus, Seers of about 22 Seers to a Maund of 58-10.			Haldi per Maund of 58-10 Sa. Wt. per Seer.		
			Mds.	Srs.	Chts	Mds.	Srs.	Chts	Mds.	Srs.	Chts	Mds.	Srs.	Chts	Rs.	As.	Gs.	Mds.	Srs.	Chts	Rs.	As.	Gs.
	1210	1803-4	1	16	0	1	21	9	0	16	0	0	7	11	10	0	0	0	16	4	2	1	4
	1211	1804-5	1	11	8	1	17	2	0	16	0	0	13	4	10	0	0	0	17	0	1	10	13
	1212	1805-6	1	33	5	1	38	14	0	13	0	0	15	0	8	15	0	0	15	12	1	4	0
	1213	1806-7	1	28	4	1	33	14	0	14	0	0	9	7	10	0	0	0	12	12	1	11	16
	1214	1807-8	0	31	6	0	36	15	0	14	0	0	8	11	10	0	0	0	16	0	2	0	0
	1215	1808-9	1	11	2	1	17	2	0	12	0	0	7	11	11	7	0	0	21	4	1	14	10
	1216	1809-10	1	2	9	1	18	2	0	13	0	0	8	0	11	7	0	0	11	4	1	10	13
	1217	1810-11	1	1	0	1	7	0	0	15	0	0	8	0	10	0	0	0	8	0	2	3	11
	1218	1811-12	1	3	10	1	9	4	0	16	0	0	8	11	9	6	10	0	20	0	2	0	0
	1219	1812-13	1	12	9	1	18	2	0	15	0	0	8	6	10	0	0	0	15	0	2	3	1
Total of 10 Years............			13	1	1	14	19	0	3	2	0	2	14	13	101	3	10	4	3	4	18	1	18
Ditto calculated at 80 Sa. Wt. per Seer................			11	37	10	13	9	14	2	25	12	1	29	9	138	2	10	2	39	12	25	9	10
Or on an average per annum..			1	7	12	1	12	15	0	10	9	0	7	0	13	13	1	0	12	0	2	8	19

No. VI.

AVERAGE Price of Fine and Coarse Rice at *Elambazár*.

	Bengal Style.	A. D.	FINE. Prices in Pus, weight 73-4 Sa. Wt. per Seer: per Rupee.			COARSE. Prices in Pus, per Rupee.			COARSE. Prices in Ascar following, per Rupee.		
			Mds.	Srs.	Chts.	Mds.	Srs.	Chts.	Mds.	Srs.	Chts.
	1190	1783-4	0	35	0	0	36	0	0	30	0
	1191	1784-5	1	15	0	1	30	0	1	15	0
	1192	1785-6	2	9	0	2	16	0	1	18	0
	1193	1786-7	1	24	0	1	30	0	1	15	0
	1194	1787-8	1	14	0	1	18	0	0	35	0
	1195	1788 9	1	2	0	1	5	0	0	32	0
	1196	1789·90	1	11	0	1	27	0	1	20	0
	1197	1790-1	1	37	0	2	5	0	1	25	0
	1198	1791·2	6	37	0	0	38	0	0	27	0
	1199	1792-3	1	18	0	1	12	0	1	5	0
Total of 10 Years..............			14	2	0	15	27	0	11	22	0
Ditto calculated at 80 Sa. Wt. per Seer..................			12	34	9	14	14	0	10	23	1
Or on an average per annum....			1	11	7	1	17	7	1	2	5
	1200	1793-4	1	20	0	1	24	0	1	10	0
	1201	1794-5	2	10	0	2	20	0	2	0	0
	1202	1795·6	2	10	0	2	20	0	2	0	0
	1203	1796-7	1	26	0	1	31	0	1	28	0
	1204	1797-8	1	27	0	1	33	0	1	20	0
	1205	1798·9	2	16	0	2	26	0	1	37	0
	1206	1799-18	1	37	0	2	5	0	1	20	0
	1207	1800-1	2	3	0	2	10	0	1	28	0
	1208	1801-2	1	33	0	2	0	0	1	25	0
	1209	1802-3	1	25	0	1	31	0	1	20	0
Total of 10 Years..............			19	7	0	21	0	0	16	28	0
Ditto calculated at 80 Sa. Wt. per Seer..................			17	22	5	19	9	2	15	11	10
Or on an average per annum....			1	30	3	1	36	15	1	21	2

No. VI.—(*continued*).

	Bengal Style.	A. D.	FINE. Prices in Pus, weight 73-4 Sa. Wt. per Seer: per Rupee.			COARSE. Prices in Pus, per Rupee.			COARSE. Prices in Assar following, per Rupee.		
			Mds.	Srs.	Chts.	Mds.	Srs.	Chts.	Mds.	Srs.	Chts.
											0
	1210	1803-4	1	17	0	1	22	0	1	7	0
	1211	1804 5	1	12	0	1	17	0	1	5	0
	1212	1805 6	1	23	0	2	0	0	1	25	0
	1213	1806-7	1	25	0	1	30	0	1	10	0
	1214	1807-8	0	34	0	0	35	0	0	30	0
	1215	1808-9	1	14	0	1	17	0	1	8	0
	1216	1809-10	1	13	0	1	17	0	1	5	0
	1217	1810-11	1	0	0	1	3	8	0	32	0
	1218	1811-12	1	0	0	1	3	0	1	4	0
	1219	1812-13	1	13	0	1	16	0	1	3	0
Total of 10 Years...............			13	0	0	14	0	8	11	19	0
Ditto calculated at 80 Sa. Wt. per Seer..................			11	36	2	12	33	3	10	20	4
Or on an average per annum....			1	7	10	1	11	5	1	2	0

It is difficult to ascertain a standard for ploughing cattle, but to judge from experience since 1793, the prices have risen gradually to about 75 per cent. on the prices of that year. The hire of coolies during the same period has not altered, being 4½ and 5 *puns* per day. The rise in wages paid by natives, who cultivate their land by labourers, has, however, been considerable; about 1793, an able servant received about 4 rupees per annum, with his diet and clothing, whereas they now receive 6 and 8 rupees yearly, and in some situations even more.

No. VII.

WHOLESALE Price of Coarse Rice in *Pús* at *Máucaur*, in Zillah *Burdwan*.

	Bengal Style.	A. D.	60 Sa. Wt. per Seer: per Rupee.			80 Sa. Wt. per Seer: per Rupee.		
			Mds.	Srs.	Chts.	Mds.	Srs.	Chts.
	1190	1783-4	1	34	0	1	15	8
	1191	1784-5	3	4	0	2	13	0
	1192	1785-6	4	28	0	3	21	0
	1193	1786-7	3	2	0	2	11	8
	1194	1787-8	2	28	0	2	1	0
	1195	1788-9	1	30	0	1	12	8
	1196	1789-10	3	4	0	2	13	0
	1197	1790-1	4	3	0	3	2	4
	1198	1791-2	1	17	0	1	2	12
	1199	1792-3	2	34	0	2	5	8
Total of 10 Years			28	24	0	21	18	0
Or on an average per annum			2	35	0	2	5	12
	1200	1793-4	2	3	0	1	22	4
	1201	1794-5	3	20	0	2	25	0
	1202	1795-6	3	5	0	2	13	12
	1203	1796-7	2	38	0	2	8	8
	1204	1797-8	2	32	0	2	4	0
	1205	1798-9	4	22	0	3	16	8
	1206	1799-10	3	37	0	2	37	12
	1207	1800-1	2	2	0	1	21	8
	1208	1801-2	3	12	0	2	19	0
	1209	1802-3	3	4	0	2	13	0
Total of 10 Years			31	15	0	23	21	4
Or on an average per annum			3	5	0	2	14	2
	1210	1803-4	3	6	0	2	14	8
	1211	1804-5	2	20	0	1	35	0
	1212	1805-6	3	27	0	2	30	4
	1213	1806-7	2	39	0	2	9	4
	1214	1807-8	2	31	0	2	3	4
	1215	1808-9	2	7	0	1	25	4
	1216	1809-10	3	12	0	2	19	0
	1217	1810-11	2	6	0	1	24	8
	1218	1811-12	2	2	0	1	21	8
	1219	1812-13	2	20	0	1	35	0
Total of 10 Years			27	10	0	20	17	8
Or on an average per annum			2	29	0	2	1	12

XIV.

Descriptions of Two new Species of SARCOLOBUS, *and of some other Indian Plants.*

By N. WALLICH.

FEW genera of plants are more difficult to be examined and ascertained than those which constitute the *Asclepiadeæ:* a family which has lately been established and most excellently described by the librarian to the Linnean Society, Mr. R. BROWN, in a paper inserted in the first volume of memoirs of the Wernerian Natural History Society. This difficulty is owing to the general intricacy and frequent minuteness of their sexual organs and to their succulent habit, which often materially affect their appearance after they have undergone the process of drying. It is, therefore, highly desirable that as many as possible of them should be examined in a fresh and native state. Under this impression, I trust, that the following descriptions and drawings of two plants, belonging to a very interesting and singular genus established by Mr. BROWN, may not be unacceptable to lovers of botany. Both of them were brought to me a short time ago from the Sunderbans, and introduced into the Botanic Garden at Calcutta, where they thrive very well at a place which is daily irrigated by the tides of the brackish water of the river Hoogly.

SARCOLOBUS.

Brown in Act. Soc. Wernerianæ I. p. 34.
Pentandria Digynia. Ordo naturalis *Asclepiadeæ*, a Cl. VIII. Ord. XIV *Apocinearum Juss:* separandæ.

CHARACTER GENERIS.

Calyx quinquefidus, persistens, basi extra corollam corpusculis s. glandulis quinque cylindricis minutis laciniis alternantibus.
Corolla rotata, quinquefida, æstivatione imbricata. *Tubus* nullus.
Corpus stamineum subglobosum, sessile, nudum.
Antheræ ovatæ, obtusæ, stigmati incumbentes, membranaceo-marginatæ, intus cellulis duabus divergentibus.
Massæ pollinis decem, cereaceæ, læves, per paria ad latera stigmatis approximatæ, incumbentes, divergentes, basi suffultæ processibus corpusculorum stigmatis.
Ovaria duo oblonga, acuta, unilocularia, polyspora.
Ovula horizontalia,· axi adfixa.
Styli brevissimi, acuti.
Stigma depressum, pentagonum, antheris tectum, angulis baseos porrectis corpusculiferis. *Corpuscula* teretia, dorso sulco exsculpta, basi utrinque exferentia processum capillarem horizontalem apice incurva polliniferum*.

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* These bodies do not belong exclusively to the *Asclepiadëæ*, but are found likewise in the *Apocyneæ*. In Roxburgh's Nerium grandiflorum (Cat. hort. beng.) they are very large, membranaceous, brown, obovate, loosely adhering to the somewhat flattened sides of the stigma and covered entirely by the anthers. By a peculiar process, issuing from their acute base and elongated downwards and upwards, they are attached to the grooves of the stigma, between the projecting angles of its base, and to the margins of the corresponding anthers. At the bursting of the cells the granular pollen is forced to remain on the viscid surface of these bodies. This shrub is not a Nerium, and forms probably a new genus.

Pericarpium. *Folliculus* carnosus vel coriaceus, ventricosus.

Receptaculum fungosum, amplum, sutura adfixum, demum liberum.

Semina numerosa, inversa, retrorsum imbricata, complanata, hinc leviter convexa, inde concava, margine lato membranaceo integerrimo cincta. *Testa* membranancea, intus præsertim ad marginem seminis spongiosa, ad superficiem ventralem inscripta funiculo umbilicali ramoso. *Membrana interna* tenuissima, albumen arcte vestiens.

Albumen embryoni conforme, carnosum, tenuissimum, aqueo-album.

Embryo rectus, dicotyledoneus. *Cotyledones* magnæ, foliaceæ. *Plumula* punctiformis. *Radicula* supera, cylindrica.

Habitus. *Frutices* volubiles, glabri, ramis copiosis elongatis subarticulatis, lacte spisso glutinoso scatentes. *Folia* opposita, glabra, firma, basi supra acervulo glandularum. *Racemi* extrapetiolares, corymbosi, parvi. *Folliculi* solitarii (per abortum.)

SARCOLOBUS globosus Wall.

S. foliis ovato-oblongis, corollis intus villosis, folliculis magnis carnosis globosis utrinque retusis muricatis.

Habitat ad littora subsalsa fluminis *Hoogly* Bengalæ australis.

Frutex ramosissimus, late super arbusculas volubilis, cortice pallido glaberrimo calloso-punctato.

Rami graciles, teretes, ad insertionem foliorum noduloso-incrassati ; tenelli pubescentes.

Folia petiolata, opposita, remota, patentia, ovato-oblonga, juniora ovato-cordata, acuta cum cuspidula, integerrima, basi rotundata s. leviter emarginata, supra ad insertionem petioli setis aliquot carnosis ætatè nigricantibus, coriacea, lævia, tri-quadripollicaria, subtus glauca costa elevata nervisque puberulis versus marginem arcuatim anastomosantibus, siccitate reticulata.

Petioli teretes, graciles, supra sulcati, foliis triplo breviores.

Racemi extra axillares, corymbosi, multiflori, longitudine petiolorum, raro divisi.

Pedunculus pubescens. *Pedicelli* clavati, spiraliter rachi incrassatæ inserti, basi bracteolis tribus carnosis triangularibus.

Flores parvi, extus albicantes, puberuli.

Calyx quinquefidus. Laciniæ acutæ, ciliatæ. *Granula* quinque in fundo.

Corolla rotata, quinquifida. Laciniæ ovatæ, acutæ, supra villosæ, punctulis seriatis purpureis.

Corpus stamineum aurantiacum. *Antheræ* obtusæ, membranula nivea marginatæ. *Massæ pollinis* respectu paris divergentes.

Ovaria et *Styli* ut in genere.

Stigma omnino occultum antheris.

Folliculus globosus, hinc leviter carinatus obliquus, carnosus, diametri quadripollicaris, vertice basique retusus. *Cortex* cinereus, asper a punctis innumeris elevatis callosis farinosis. *Caro* fungosus, albus, admodum lactescens. *Tunica interna* chartacea, lævissima.

Receptaculum album, fungosum, cultriforme, dorso convexum, vertice subglobosum et notatum seriebus cicatricularum longitudinalibus, quibus inseruntur semina; basi læve.

Semina numerosissima, retrorsum imbricata, globum formantia exactissime cavitatem folliculi replentem, obovata, pollicaria, leviter convexo concava, lævissima, ferruginea, disco dilutiora, a pressura lineata, margine acutissima.

Cotyledones obovatæ, basi leviter retusæ.

SARCOLOBUS carinatus Wall.

S. foliis ovalibus oblongisque, subcarnosis, corollis lævibus, folliculis oblongis lævibus acutis subtus carinatis.

Habitat cum antecedente.

Frutex præcedenti similis sed minor.
Rami longissimi, gracillimi, laxi, penduli, articulis inferioribus sæpe repentibus.
Folia breve petiolata, lato-ovata, utrinque acuta, vel obovata subretusa, adultiora oblonga, pollicaria ad tripollicaria, crassa, carnosa, utrinque lævia, basi papilloso-glandulosa, avenia, subtus incana.
Petioli teretes, supra sulcati, unguiculares, pubescentes.
Racemi extra-axillares parvi.
Bracteolæ ad basin pedicellorum triangulares.
Flores parvi, glaberrimi.
Calyx quinquepartitus. Laciniæ oblongæ. *Granula* quinque exigua.
Corolla rotata, plana, lævis, ex viridi lutea, supra punctis seriatis purpurascentibus, versus faucem tuberculis quinque minutis.
Corpus stamineum, *Ovaria* et *Styli* ut in genere.
Stigma vertice nudum.
Folliculus oblongus, utrinque attenuatus, leviter arcuatus, acutus, subventricosus, coriaceus, lævis, supra planiusculus, carinis duabus quatuorve lateralibus sinuosis angustis, pollices tres longus, maturitate flavus viridi-maculatus. *Loculamentum* ovatum, acutum.
Receptaculum subcylindricum, arcuatum, acuminatum, seriebus octo cicatricularum, totidemque foveolis notatum.
Semina retrorsum imbricata, unguicularia.
Observation. Though both these plants grow abundantly every where in the jungles of the extensive Sunderbans, I have not been able to ascertain satisfactorily their native names ; nor have I succeeded in tracing any synonymes of them. They seem even to have escaped the notice of that most acute observer and botanist Doctor ROXBURGH. They are very distinct by their flowers and fruits. Their leaves are less different, and vary much in the last species from oval to almost linear. *S. carinatus* is altogether a slenderer and smaller shrub. The spongy flesh of its receptacles

is of a mild milky taste, and used by the natives in their curries.

Flowering time, the hot and rainy seasons. The fruits ripen towards the close of the rains.

CAMPANULA dehiscens.

ROXBURGH, CAT. hort. beng. p. 85.

C. annua pilosula, basi ramosa, foliis linearibus denticulatis, floribus terminalibus, capsulis apice poris tribus dehiscentibus.

Habitat in agris Bengalæ frequenter.

Planta erecta, pedalis, annua, adspersa pilis paucis brevibus; basi ramosà.

Rami subsimplices, adscendentes, fastigiati.

Folia alterna, sessilia, patentia, linearia, remote denticulata, basi attenuata, bipollicaria, margine costaque leviter pilosa, superiora et floralia integerrima.

Flores parvi, glabri, dilute cœrulei, ad apicem caulis et ramorum pauci, alterni.

Pedunculi filiformes, bracteolis aliquot linearibus.

Calyx superus quinquepartitus. Laciniæ lineares, acutæ, erectiusculæ.

Corolla campanulata, quinquefida, calyce duplo longior. Laciniæ ovatæ acutæ.

Stamina corolla breviora.

Filamenta capillaria, erecta, e basi dilatata ciliata conniventia.

Antheræ lineares, erectæ.

Ovarium læve, oblongum, trisulcatum, intra calycem leviter elevatum, subtrilobum, triloculare polysporum. *Ovula* axi inserta.

Stylus longitudine staminum, pubescens.

Stigma trilobum, villosum.

Capsula membranacea, subcylindrica, fusca, calycis laciniis erectiusculis coronata, trilocularis, apice poris tribus dehiscens. *Dissepimenta* apice prominula.

Semina minuta, numerosissima.

Observation. Among the few genera, which this country has in common with *Europe*, that of campanula holds a place. This species has, however, only a faint resemblance to our lovely bell-flowers, and nothing of their beauty. It is a simple small plant, which flowers in *February* and *March*.

BAUHINIA RACEMOSA.

Bauhinia foliis subrotundo-cordatis, lobis semi-orbiculatis, subtus tomentosis, staminibus barbato plumosis. *Lamarck Encycl.* I. 390.

Bauhinia floribus triandris, extus staminibusque basi hirsutis, foliis subtus sericeis, lobis rotundatis. *Vahl. Symb.* III. 56. *tab.* 62.

Habitat in montibus Bengalæ orientalis ad *Monghyr*, *Gualpara*, *Nepal*, alibique super arbores altissimos scandens.

Truncus arboreus, robustus, cortice cinereo, rimoso.

Rami longissimi, teretes, fusci, superne vestiti tomento denso molli; juniores ferruginei, striati.

Folia alterna, petiolata, patentia, rotundato-cordata, subreniformia, amplissima, palmaria ad pedalia, integerrima, biloba: lobis rotundatis subdivaricatis; dum juniora mollissima, supra læte viridia pubescentia, subtus nervique ferrugineo tomentosa, adultiora glabriora, coriacea, tredecimnervia, venosa, nervo costali inter lobos in setam lineari lanceolatam semipollicarem excurrente.

Stipulæ oblongæ, subfalcatæ, recurvatæ, unguiculares, deciduæ.

Petioli tri-ad sexpollicares, teretes, ferrugineo-tomentosi, utrinque intumescentes, ad insertionem folii subbilobi.

Cirrhi duo oppositi, crassi, plani, integri, sexpollicares et ultra, revoluti, tomentosi, demum lignosi.

Racemi terminales, pedunculati, ampli, ovati, corymbosi, multiflori, incano-tomentosi.

Pedunculus crassus, sursum floriferus, ad basin singulorum pedicellorum *bracteis* patentibus lanceolatis acutis persistentibus.

Pedicelli sparsi, patentissimi, teretes, bipollicares, apice bracteola una vel duabus subulatis, superiores sensim breviores.

Flores magni, candidi, demum lutescentes.

Calyx tubulosus, ad dimidium quinquefidus, limbo reflexo. Laciniæ lanceolatæ, concavæ, unguiculares, membranula tenui alba in duos lobos connexæ.

Corolla pentapetala, patentissima. *Petala* pollicaria, ovata, crenata, undulata, basi in unguem linearem longitudine laciniarum calycis attenuata, sericeo-barbata, margine intusque glabriora.

Stamina octo, fauci calycis inserta. Quinque sterilia capillaria petalorum unguibus breviora: quorum duo instructa rudimentis antherarum.

Filamenta fertilium cylindrica, carnosa, arcuata, petalis longiora, basipilosa.

Antheræ magnæ, luteæ, oblongæ, incumbentes.

Ovarium tubo calycis hinc adnatum, oblongum, dense lanatum.

Stylus adscendens, staminibus longior, sanguineus, pilosus.

Stigma capitatum, viride, læve.

Legumen oblongum, lignosum, pedale, digitos tres latum, compressum, apice rotundatum cum stylo obliquo brevi, basi parum angustatum, marginibus rectilineis, tomento ferrugineo denso mollissimo vestitum, sex-ad octoloculare. *Dissepimenta* lignosa, brevia. *Loculamenta* lævissima, polita, vix ultra tertiam latitudinis partem occupantia.

Receptaculum. *Funiculi* magni, triangulares, valde complanati, coriacei, e sutura externa descendentes, apice semilunari truncata.

Semina solitaria, subrotunda transversaliter parum oblongata, pollicaria, compressa, utrinque planiuscula, lævissima, nitida, stria ocellari obsoleta submarginali. *Umbilici fenestra* in parte exteriore superiore excavata semilunaris.

Integumentum simplex, durum, coriaceum.

Albumen durum, tenue, aqueo-album.

Embryo rectus, lutescens. *Cotyledones* magnæ, amyg-

dalinæ, flavescentes, planæ basi, leviter sigmoideæ, obsolete nervosæ, lævissimæ. *Plumula* minima. *Radicula* conica, centrifuga.

Observation. This is one of the most stately and gigantic climbers in the world; its stem often measuring eighteen inches in diameter and its branches covering, and at last suffocating, the largest trees. The flowers are beautifully white, becoming yellowish before they decay. Its profuse and elegant foliage is employed by the natives to cover their huts, umbrellas, &c.; uses for which the strong and leathery texture of the leaves renders them exceedingly well qualified. The cotyledons are not unpleasant to the taste, and are eat by the natives.

Hindustani name *Maula.* A man, who has seen the tree at both places, tells me it is called *Latá Kanchaná* at Monghyr, in Nepal *Bhurla.*

Flowering time, the hot and rainy seasons. The pods take nine months to ripen.

EXPLANATION OF THE PLATES.

SARCOLOBUS globosus.

Fig. a. a. Front and back view of a flower.
b. Calyx opened, exhibiting its small glandular bodies, and the ovaria.
c. Corpus stamineum.
d. The same, with the anthers removed, more magnified.
i. Fruit, natural size.
k. The same, opened.
e. e. Seeds viewed from both sides.
f. The same, transversally divided.
g. The same, longitudinally divided, showing the albumen.
h. Embryo, natural size.

SARCOLOBUS carinatus.

Fig. a. a. Flower.
b. Corpus stamineum.
c. Internal side of the anther, shewing the cells.
d. Fruit.
e. The same, longitudinally divided.
f. Seeds attached to the receptacle.
g. Receptacle.
h. h. Seeds.

CAMPANULA dehiscens.

Fig. a. Coral.
b. Calyx and stamens.
c. A detached stamen.
d. Pistil.
e. Transversal section of the ovarium.
f. Capsule.
g. The same, divided transversally.
h. The same, opened so as to shew a loculament.

BAUHINIA racemosa.

Fig. a. b. Calyx and sexual organs.
c. c. Petals.
d. Legume.
e. Seed with its funiculus.
f. g. The same, in a germinating state.

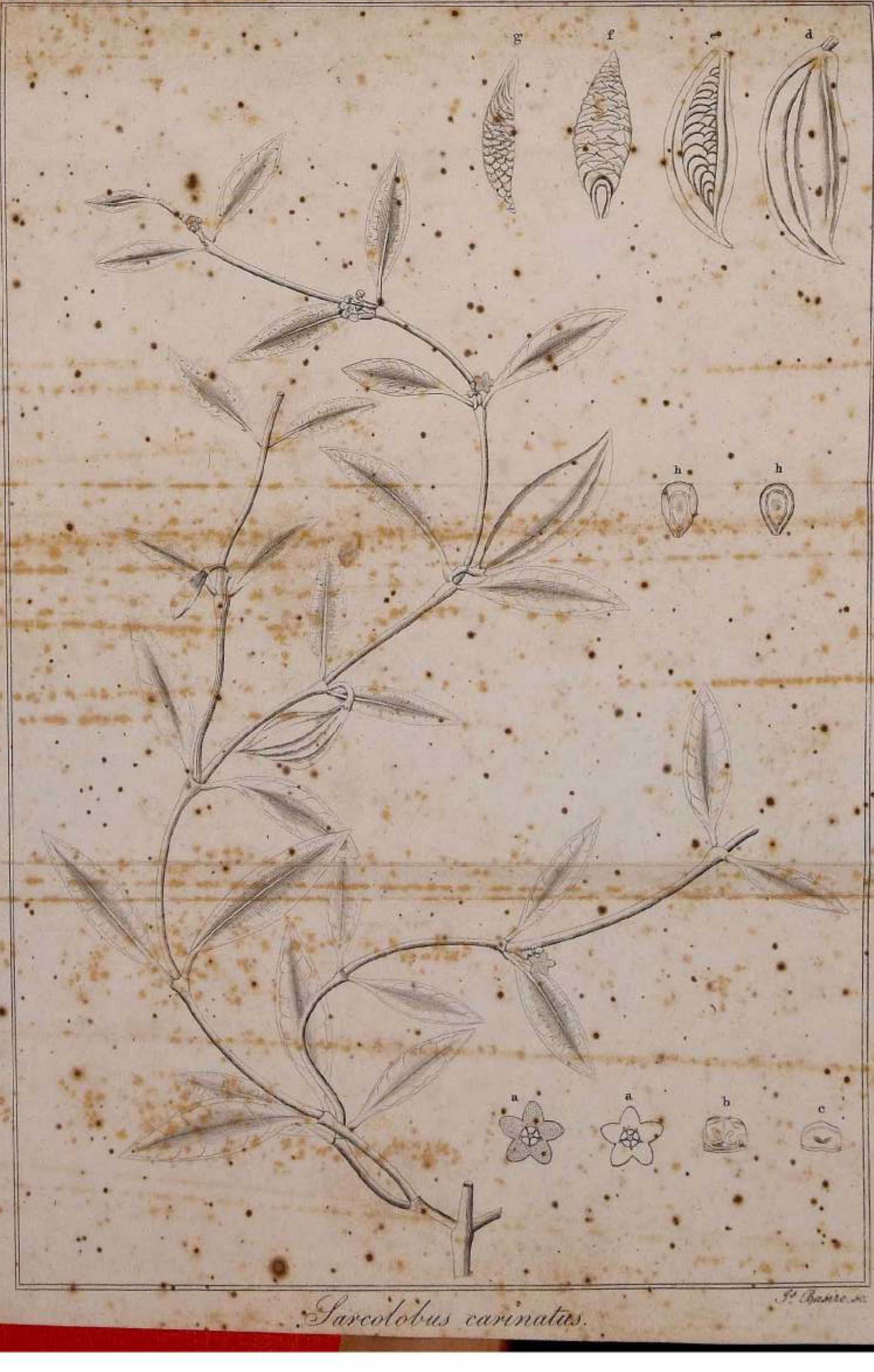
THE END OF THE TWELFTH VOLUME.

Sarcolobus globosus.

Jˢ Basire sc.

Published by John Murray, London 1817.

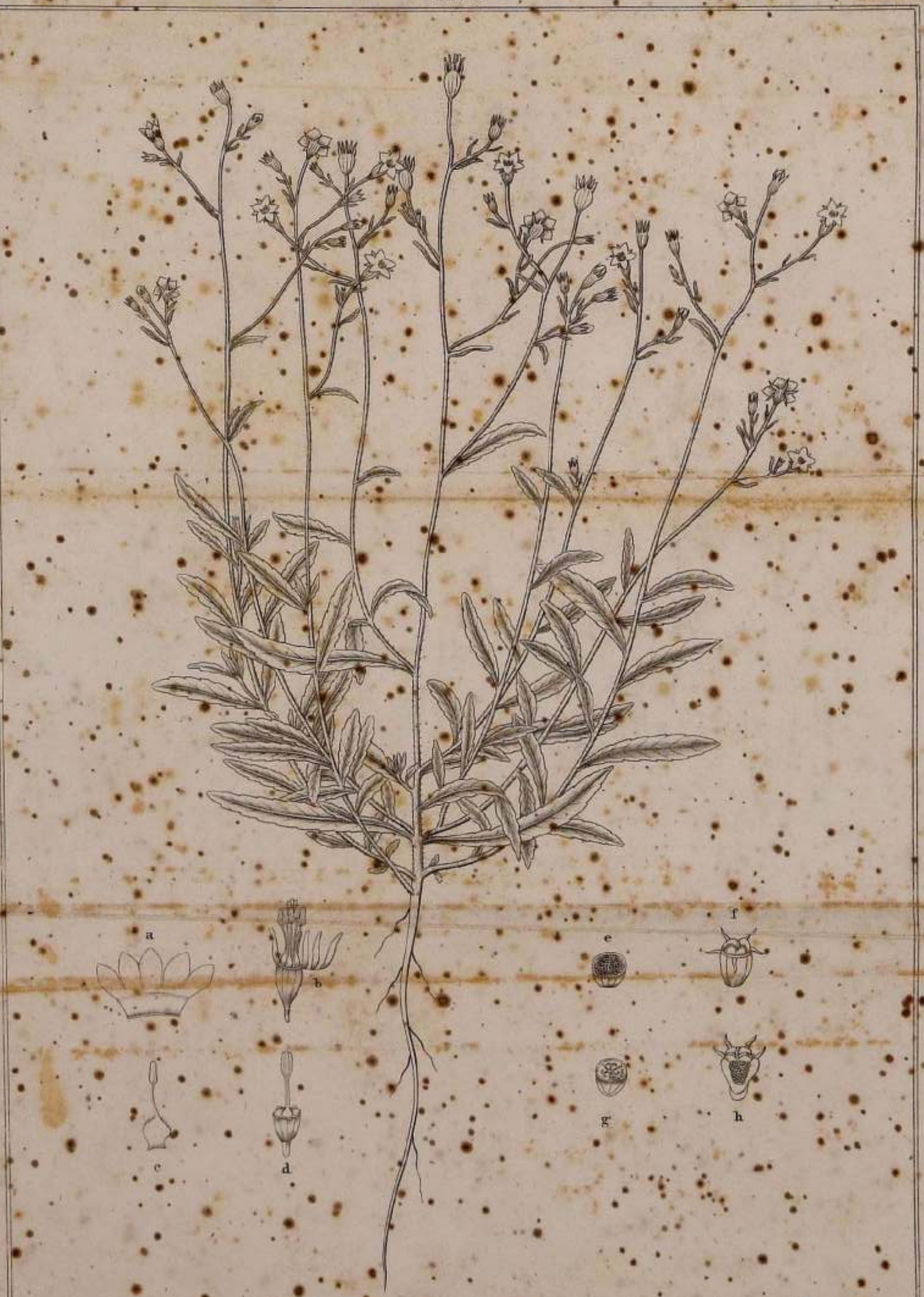
585



Sarcolobus carinatus.

J. Basire sc.

PL. VI.



Campanula dehiscens Roxb.

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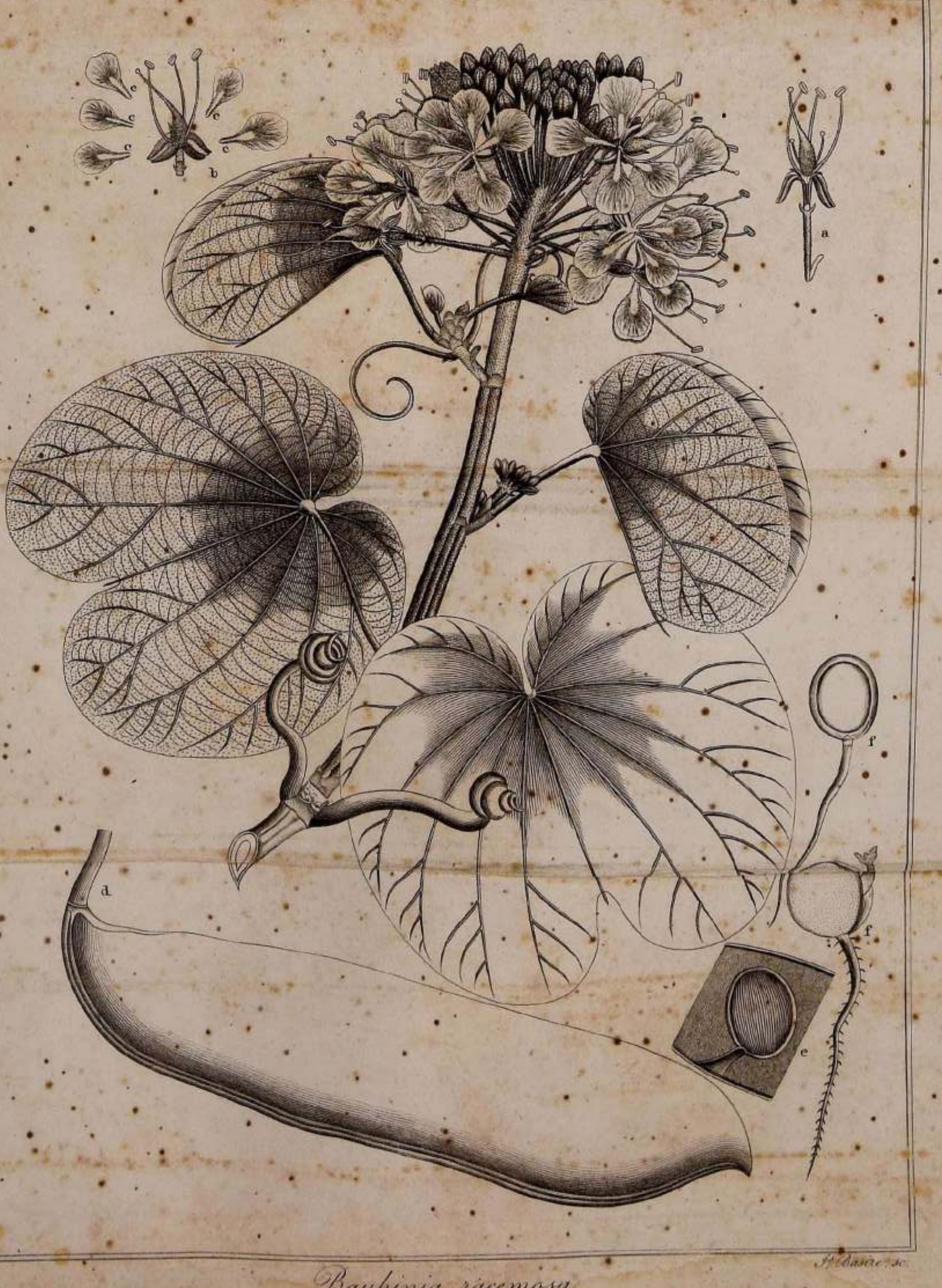
Published by John Murray, London, 1817.

PL. VII.



J. Basire sc.

Bauhinia racemosa.

Published by John Murray London 181

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APPENDIX.

RULES
OF
THE ASIATICK SOCIETY.

THE following is an abstract of the Rules of this Institution, which are now in force; including those printed in the Appendix to the sixth and subsequent Volumes of the Society's Transactions:

Original Rules adopted from the Founder's Discourse, 15*th February*, 1784.

1. That the institution be denominated the *Asiatick Society*: that the bounds of its investigations be the geographical limits of *Asia*; and that within these limits, its inquiries be extended to whatever is performed by man, or produced by nature.

2. That weekly meetings be held for the purpose of hearing original papers read, on such subjects as fall within the circle of the Society's inquiries.

3. That all curious and learned men be invited to send their tracts to the Secretary; for which they shall immediately receive the thanks of the Society.

4. That the Society's researches be published annually, if a sufficiency of valuable materials be received.

5. That mere translations of considerable length be not admitted, except of such unpublished essays or

treatises as may be transmitted to the Society, by native authors.

6. That all questions be decided on a ballot, by a majority of two-thirds, and that nine Members be required to constitute a Board for such decisions.

7. That no new Member be admitted who has not expressed a voluntary desire to become so; and in that case, that no other qualification be required than a love of knowledge, and a zeal for the promotion of it.

Subsequent Resolutions of the Society, which are in force.

8. That the future meetings of the Society be held on the first *Wednesday* of each alternate month; viz., in the months of *February*, *April*, *June*, *August*, *October*, and *December*, at nine o'clock in the evening.

9. That if any business shall occur to require intermediate meetings, they may be convened by the President; who may also, when necessary, appoint any other day of the week, instead of *Wednesday*, for the stated meetings of the Society.

10. That as it may not always be convenient for the President to attend the meetings of the Society, a certain number of Vice Presidents be elected annually.

11. That in case the President and the Vice Presidents should be absent at any meeting, a quarter of an hour after the fixed time, the Senior Member present shall take the chair for the evening.

12. That every Member of the Society have the privilege of introducing, as a visitor, any gentleman who is not usually resident in *Calcutta*.

13. That, with a view to provide funds for the necessary expenses of the Society, an admission fee be established, to consist of two gold mohurs, payable by every Member on his election; and that each Member of the Society, resident in India, (honorary Members excepted,) do also contribute a gold mohur quarterly, in the first week of *January*, *April*, *July*, and *October*. Any Member, neglecting to pay his subscription for half a year after it becomes due, to be considered as no longer a Member of the Society.

14. That a Treasurer be appointed.

15. That in addition to the Secretary, an assistant Secretary, and a Librarian, be also appointed.

16. That a Committee of Papers be appointed, to consist of the President, Vice Presidents, Secretary, and nine other Members, to be elected annually; and that any number, not less than five, be competent to form a Committee.

17. That this Committee select from the Papers communicated to the Society such as may appear proper for publication; and superintend the printing of the Society's transactions.

18. That the Committee of Papers be authorized to draw upon the Treasurer for any sums requisite to defray the expense of publishing the transactions; and that an order, signed by a majority of the Committee, be a sufficient warrant to the Treasurer for paying the same.

19. That the Committee of Papers be authorized to defray any small contingent expenses, on account of the Society, which they may deem indispensable.

20. That the agents of the Society in *England* be

desired to purchase and forward for the Society's Library, books of science and oriental literature published in *Europe,* taking care that those purchases at no time exceed the funds arising from the sale of the Society's publications.

21. That the Committee of Papers be requested to furnish the Agents in *Europe,* with such further instructions as may appear requisite for their guidance in the selection of books proper to be placed in the Library of the Society.

22. That it will be proper to publish, with each volume of the Researches, a list of such oriental subjects as may be considered in the light of *desiderata;* to be prepared by the Committee, from lists submitted to the Society, by the Members, or others.

23. That as a testimonial to the merit of the best papers, communicated to the Society, on the subjects proposed as *desiderata,* the author, when not a member of the Society, be presented with the volume of Researches, wherein such paper is contained; accompanied with a complimentary letter from the Secretary, in the name of the Society.

24. That every subscribing Member of the Society be, on application, furnished with a copy of the 12th volume, as well as of any future volumes of the Society's Transactions, in return for his contributions, without any further payment.

25. That with a view to the more general circulation of the *Asiatick* Researches in *India,* the price of the 12th and future volumes, to non-subscribers, be fixed at a gold mohur; and that if several volumes of different years be purchased together, they be sold at ten rupees each.

MUSEUM.

26. On the 2d *February*, 1814, the Society determined "upon forming a Museum for the reception of all articles that may tend to illustrate oriental manners, and history; or to elucidate the particularities of nature or art in the East." The following Resolutions were at the same time passed upon the subject:—

27. That this intention be made known to the public, and that contributions be solicited of the undermentioned nature:—

1. Inscriptions on stone or brass.
2. Ancient monuments, *Mohammedan* or *Hindu*.
3. Figures of the *Hindu* deities.
4. Ancient coins.
5. Ancient manuscripts.
6. Instruments of war peculiar to the East.
7. Instruments of music.
8. The vessels employed in religious ceremonies.
9. Implements of native art and manufacture, &c. &c.
10. Animals peculiar to *India*, dried or preserved.
11. Skeletons or particular bones of animals peculiar to *India*.
12. Birds peculiar to *India*, stuffed or preserved.
13. Dried plants, fruits, &c.
14. Mineral or vegetable preparations in Eastern pharmacy.
15. Ores of metals.
16. Native alloys of metals.
17. Minerals of every description, &c. &c.

28. That the names of persons contributing to the Museum or Library of the Society, be hereafter published at the end of each volume of the *Asiatick* Researches.

29. That the hall on the ground-floor of the Society's

house be fitted up for the reception of the articles that may be procured. The plan and expenses of so doing to be regulated by the Committee of Papers, and Secretary; and the person under whose superintendence the Museum may be placed.

30. That the expense which may be incurred in preparing materials, furnished in a state unfit for preservation, be defrayed by the Society, within a certain and fixed extent.

31. That the thanks of the Society be given to Doctor WALLICH, for the tender of his services; and that he be appointed Superintendent of the Oriental Museum of the *Asiatick* Society.

32. On the 5th *April* 1815, in consequence of Doctor WALLICH's being obliged to reside at some distance from *Calcutta*, it was resolved, at his suggestion, to appoint a joint Superintendent of the Society's Museum, and Mr. WILLIAM LLOYD GIBBONS, who is also Assistant Secretary and Librarian to the Society, was accordingly requested to act as joint Superintendent with Doctor WALLICH.

33. On the 7th *June* 1815, the Superintendents of the Museum were requested "to return the thanks of the Society to the persons from whom any donation to the Museum has been received, and to make similar acknowledgments for any contribution which may be hereafter made to the Museum."

BIBLIOTHECA ASIATICA.

The following resolutions were passed, on the recommendation of the Committee of Papers, under date the 2d *July* 1806. But materials have not yet been received for publishing a volume of the work therein proposed.

34. That the Society publish, from time to time, as their funds will admit of it, in volumes distinct from the *Asiatick* Researches, translations of short works in the *Sanscrit* and other *Asiatick* languages, or extracts and descriptive accounts of books of greater length in those languages, which may be offered to the Society, and appear deserving of publication.

35. That as this publication may be expected gradually to extend to all *Asiatick* books, of which copies may be deposited in the Library of the Society, and even to all works extant in the learned languages of *Asia*, the series of the volumes be entitled *Bibliotheca Asiatica*, or a descriptive Catalogue of *Asiatick* Books, with Extracts and Translations.

36. That the Committee of Papers, adopt such means as may appear proper, for making the intentions of the Society in this respect generally known.

Physical and Literary Committees.

37. At the suggestion of one of the Members of the Society, it was resolved, on the 7th *September* 1808; *First*, That a Committee be formed to propose such plans and carry on such correspondence as may seem best suited to promote the knowledge of natural history, philosophy, medicine, improvements of the arts, and whatever is comprehended in the general term of *physics;* to consist of such Members as may voluntarily undertake to meet for that purpose. *Secondly*. That a Committee be formed in like manner, for literature, philology, history, antiquities, and whatever is comprehended under the general term of *literature*.

38. The following Rules for the two Committees were also adopted by the Society, on the 5th *October* 1808:—

1st. That the meetings of the Literary Committee be held at the house belonging to the *Asiatick* Society, on the first and third *Wednesdays*, and the meetings of the Physical Committee on the second and fourth *Wednesdays* of each month, at the hour of nine o'clock in the evening: whenever a general meeting of the *Asiatick* Society may be held on the same evening, and at the same hour, the meeting of the Committee to be suspended. 2d. That each Committee be open to all Members of the *Asiatick* Society, who may choose to attend the meetings. 3d. That if the President of the Society be present at a meeting of either Committee he shall preside; in his absence one of the Vice Presidents; and in their absence the eldest Member of the Society present at each meeting shall be considered as President at such meeting. 4th. That the Secretary to the *Asiatick* Society be requested to act as Secretary to the Literary Committee, and the Assistant Secretary to the Society be requested to act as Secretary to the Physical Committee, as far as their time and avocations may admit. 5th. That a Deputy Secretary be also appointed for each Committee, to be elected at the next meeting of the two Committees respectively. 6th. That regular books of proceedings be kept by the Secretaries for each Committee, in which minutes shall be entered of all papers, communications, and acts done by the Committee; that such books be at all times open to the inspection of the Members of the *Asiatick* Society; and that such papers be laid before the Society as the Committee may judge proper to be submitted. 7th. That the correspondence of each Committee be in general carried on through its Secretary or Deputy; but that it be at the discretion of the Committees to employ any one of their Members to correspond with any individual.

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The Museum of the Asiatick Society.

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The Countess of Loudon and Moira	—A *Chinese* Pheasant, stuffed.
	Two Peacock Pheasants, ditto.
	Specimens of Vitreous Hair, from the vulcano on the Island of *Bourbon*.
Lady Hood	—A *Butan* Pheasant, or *Rúp Chand* stuffed.
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Miss F. Harington	—Various Minerals found between *Critcumsandy* and *Rogunatpore*.
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Mrs. GERARD	—Several Shells from the Isle of *France.*
J. BROWN, Esq.	—A set of Side Arms belonging to the inhabitants of *Napaul*, consisting of one cutlass, a knife, and a steel and flint for striking fire, in a leathern case.
F. BUCHANAN, Esq. M.D.	—A carved Stone containing numerous figures of BUDDHA, from the ruins of *Rajagriha*, the city of *Jarasandha*, in *Behar*.
	Three other carved Stones from the neighbourhood of the *Caratoya* river, in a southern part of *Dinájpúr*.
Rev. W. CAREY, D.D. ..	—A dried Skin of the *Ceylon* small Deer.
	A bunch of Branches with native lack, from the district of *Midnapore*.
M. CHEESE, Esq.........	—A very large Head of the common alligator, with its skin, dried.
H. T. COLEBROOKE, Esq.	—One large and three small specimens of a species of Madrepore, called by the *Hindus Dwárací-chacra*, and held in veneration by them as sacred to VISHN'U, supposed to be found near *Dwáracá*, in the gulph of *Cutch*.
	Specimens of Crystallizations found at *Griker*, a place of religious resort near *Chanda*, south of *Nagpore*.
	Two *Sáligrams* found near *Muctinát'h*, on the *Gandací* river.
	Specimens of Coal from *Sylhet*.
	A dendrite from the *Chumbul* river.
	Chrystals from the hills north of *Cutch*.
	Pebbles from the *Sone* river.
	Lead ore; place unknown.
	Specimens of Tabasheer, or manna of bamboos, from the hills bordering on *Sylhet*.
	A collection of dried specimens of *Indian* plants from the *Botanic* garden at *Calcutta*.
Captain J. COLLINGWOOD,	—Specimens of coral from the Isle of *France*.
Mr. DA COSTA..........	—Several Shells and Zoophytes from the Isle of *France*, and its neighbourhood.
G. DOWDESWELL, Esq. ..	—A pair of Horns of a hill Cow in the province of *Cuttack*, polished.
J. DUNLOP, Esq.	—Two Skulls of the Babyrussa, from *Amboyna*.

DONORS.	DONATIONS.
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	Three sets of Horns of the Hog-Deer.
	Eight Horns of different species of Deer.
	Specimens of the Beak of a species of Buceros.
	Ditto of another ditto.
	Six Beaks of different Birds.
	A Beak of the Spoon-bill.
	Two Ostrich Eggs.
	Some Teeth of a small Shark.
	The Tail of a Rattlesnake, dried.
	A hairy Concretion from the stomach of a cow.
	A small Harpoon.
	Part of the Skull of a Musk Deer.
	Two dried Fishes.
	Some Tiger Claws.
	Claws of the *Amboyna* Pigeon, and other birds.
	A brass Standish and Pen-Case.
	An iron Style.
	A brass Mirror.
	A silver Pedestal.
	A brass figure of Bhava'ni.
	Five brass casts of Buddhas.
	One ditto of Gane's'a.
	One small ditto, uncertain.
	One ditto of Parvati.
	Another ditto, ditto.
	One ditto of the infant Crĭshn'a.
	One ditto of Durga', mounted.
	One ditto of Se'sha, resting on the tortoise.
	A wooden medallion of a Buddha, with surrounding inscription.
	A brass Bhava'ni, with a lion's head and canopied by *S'ésha Nága*.
	A brass Vessel.
	A ditto Lamp.
	A crystal *Mála*.
	An Egg.
	Specimens of native Sulphur.

DONORS. DONATIONS.

Specimens of Opal.
Ditto of Benzoin.
Ditto of Crystal.
Ditto of Quartz.
Ditto of Lapis Lazuli.
Ditto of Gold Ore.
Ditto of variegated Marble.
Ditto of Mica.
A small Stone cut with the figure of a head
Three Conch Shells.
Some Tusks of a Boar.
Some Tigers' Teeth.
A small model of a Boat, from the Eastern islands.
Necklaces and Bracelets of Shells, &c. from the Eastern islands.
Fishing Tackle, from ditto.
A piece of Honeycomb.
Various Eggs.
Bracelets of Boars' Tusks, from the Eastern islands.
An *Egyptian* Lock.
A dried Sea-horse.
A *China* Flute.
A set of *China* chopsticks.
A *China* Steelyard.
Burmah Dominos and Dice.
Ditto Chessmen.
The ornamented Prow of a *Pegu* Boat.
A Sling from the Eastern islands.
The bowl of a *Chinese* Pipe.
Fishing Tackle from the Eastward.
Two Trumpets or Pipes.
Two *China* Compasses.
A large Elephant's Tusk.
A Buffalo's Horn.
Two *khargas* or *Hindu* sacrificial knives.
Two specimens of *Hindustani* Mosaic, in coloured chunam from *Golconda.*
A Tail of the Unicorn.
A model of a *Pegu* Boat.
Another ditto, ditto.
Ditto of a *Pegu* Bathing Tub.
Two *China* Pipes.
Various *Hindustani* Arrows.
A brass *Hindustani* Trumpet.
A *Mameluke* Saddle.

DONORS.	DONATIONS.
	A stone figure of CALI.
	An Elephant's molar Tooth.
Colonel C. MACKENZIE ..	—Two Horns of the Antelope Orcas of LINNÆUS, from *Africa*.
	Eight Statues of BUDDHA, from the upper Provinces.
	Nine silver Coins from ditto.
JAMES MAC KILLOP, Esq.	—A Platypus Anatinus, from *New Holland*, stuffed.
H. MASEYK, Esq........	—Some Rhinoceros Hoofs.
Lieutenant W. PRICE	—A *Hindu* marble image of S'U'RYA, or the sun.
R. RICHARDSON, Esq.....	—Three Alligator's Eggs.
Captain TAYLOR	—Two Spears from islands in the South sea.
Doctor WALLICH........	—A large Skull of an Elephant.
	A smaller ditto, divided by a vertical section.
	A ditto, together with a scapula, and the four first vertebra colli of a young elephant.
	Three Buffalo Skulls.
	Five Rhinoceros ditto.
	A Skull of the large river Alligator.
	Three ditto of the small tank ditto.
	A ditto of a Delphinus Gangeticus.
	A ditto of a Dolphin found near the Isle of *France*.
	Two sets of Sharks' Jaws.
	Some Fossil Bones and Teeth, probably of an Elephant, from the neighbourhood of *Serampore*.
	A Skull of the Boar.
	Two large and one smaller Tiger Skulls.
	A Skull of a Bear.
	A Skull of the Babyrussa.
	A ditto of a Porcupine from *Pegu*.
	A ditto of the large river Turtle.
	Two smaller ditto.
	A ditto of a large *Indian* Monkey.
	A Skull of a smaller ditto.
	A ditto of a Cangaroo from *New Holland*.
	The Head of a Pelican, stuffed, and a lower Jaw of a ditto.
	Several very large horns of the common deer.
	The Skull of an Ardea.
	Ditto of a Scolopax.

DONORS.	DONATIONS.
	The Skull of an Alcedo.
	A monstrous Skull of a Goose.
	A number of Skulls of Animals not specified.
	An entire panicle of the prickly Bamboo (*bambusa spinosa*, or ROXB.)
	A ditto of the common Bamboo (*bambusa arundinacea.*)
	Some large inflorescences, together with ripe fruits of the *Madagascar* raffia-tree (*sagus ruffia.*)
	A ditto of Urania speciosa.
	A large Crystal from *Madagascar*.
	A variety of Shells and Corals, from the Isle of *France*.
	A young Lacerta Gangetica, in spirits of wine.
	Some Abdominal Viscera of a Cangaroo, in ditto.
	A Funiculus Umbilicalis of a *Bengalee* child, with large appendices, injected with mercury.
	A specimen of a Tænia solium, expelled by the bark of pomegranate root.
	Another ditto, of a native woman.
	Some flowering branches of Loranthus bicolor, in spirits of wine.
	Specimens of various resinous productions from the Island of *Madagascar*.
	Some stems of the singular Bauhinia anguina ROXB.
Captain H. WILKINSON ..	—Four silver Coins from *Hindustan*.
H. H. WILSON, Esq.	—A *Salegram*.
	A SIVA LINGA.
	A *Rudrácsha Mala*.
	Specimens of Lead Ore from *Monghyr*.
	Ditto Copper Ore from *Nellore*.
	Ditto of four species of Corundum, or Currun Stone.
	Ditto of the *Pacheet* Stone.
	Ditto of Coal from *Burdwan*.
	Ditto of *Sone* Pebbles.
	Ditto of Sand, supposed to contain gold dust, from *Pontiana*.
	Ditto of Santa Clara Copper, highly arseniated.

ADDITIONS.

NOTE *to an* ESSAY *on the* NOTIONS *of the* HINDU ASTRONOMERS, *concerning the* PRECESSION *of the* EQUINOXES: *by* H. T. COLEBROOKE, Esq.

HAVING re-considered the passage of VISHN'U CHANDRA, quoted by the scholiast of BRAHMEGUPTA*, I am satisfied that the corrupt part of the text does not relate to the number, which appears complete without it; and I venture with confidence on an emendation, which the defect of one syllable in the verse shows to be necessary, and which perfects the sense. The passage so restored is as follows: the syllable, which I conjecturally re-establish, (and no other correction is atttempted nor required,) being distinguished by Italics.

'Tasya chátra *bha*-chid rudra-crïta-nandásh'tacéndavah Ayanasya yugam próctam Brahmárcádi-matam purá.'

'Its revolution *through the asterisms* are here [in the *calpa*] a hundred and eighty-nine thousand four hundred and eleven. This is termed a *yuga* of the solstice, as of old admitted by BRAHMA, ARCA, and the rest.'

The number of 189,411 complete revolutions, in a *calpa* of 4,320,000,000 years, gives an annual precession of 56″ 49½‴.

The age of VISHN'U CHANDRA must be placed between those of A'RYABHAT'T'A and BRAHMEGUPTA:

* See page 217.

for a passage of the last mentioned author affirms, that both he and S'RI'SHE'N'A compiled their *Vasisht'ha* and *Rómaca siddhántas* from A'RYABHAT'T'A, and VIJAYA-NANDI, &c., taking the mean motions of the sun and moon, with the lunar apogee and nodes, and other specified particulars, from the first of these authorities. To determine the period when this original author flourished is a material and interesting object of research; not only as he was founder of a sect in astronomy, as PULI'S'A was of another; both of which are noticed by BRAHME-GUPTA with their distinctive appellations, but because he is the earliest Hindu writer known to have treated of Algebra. I shall resume the inquiry in another place.

I shall here only observe, that BRAHMEGUPTA is placed by the Astronomers of *Ujjayani*, in 550 *S'aca* (A. D. 628); and that A'RYABHAT'T'A is considerably more ancient. MUNJA'LA, so frequently mentioned for the doctrine maintained by him concerning the revolution of the equinoxes *, is stated by the Astronomers of *Ujjayani* to have written in the year 854 of the *S'aca* era (A. D. 932), as BRAHMEGUPTA is in 550 *S'aca*. These dates are furnished in a list of astronomical authorities, which was communicated to the late Dr. WILLIAM HUNTER by Hindu astronomers, who assisted his studies, when he was residing at that ancient seat of Hindu astronomy. It appears deserving of some confidence, as several of the dates which it contains, particularly those of BHÓJA-RA'J and BHA'SCARA, have been verified. The rest, it may fairly be presumed, are likely to be equally correct; and VISHN'U CHANDRA, being anterior to BRAHME-GUPTA, must have preceded MUNJA'LA by more than three centuries, as the latter did BHA'SCARA by more than two. It is not the only instance, among the Hindu astronomers, where the older author has made a nearer approach to the truth, than his successor.

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* See page 312.

When the conclusion of the note at page 252 was written, a quotation from A'RYABHAT'T'A in MUNÍSWARA'S commentary on BHA'SCRA was overlooked. It is the beginning of a passage in the abridgment of A'RYABHAT'T'A, specifying the revolutions of the planets. The quotation unfortunately stops after those of the moon; which are 57,753,334,000, answering to 4,320,000,000, of the sun. His numbers then come between those of the *Súryasidd'hánta* and BRAHMEGUPTA, in the instances which admit of comparison: and the diurnal motions, concluded from them, differ from theirs but at fourth minutes.

NOTE ON PAGE 250.

To obviate misapprehension, it is necessary to observe, that the number of elapsed years of the *S'aca* era subjoined to A'RYABHAT'T'A's computation of past time, is an addition by the Scholiast of BRAHMEGUPTA, in course of comparing elapsed time, as reckoned by the two authors. For the passsage, which he twice quotes from the *Das'a-giticá* of A'RYABHAT'T'A, reckons from the the beginning of the *Calpa* to the *Bhárata*, which is the era of *Yudhish't'hira*, and the epoch employed by him, without any notice either of *S'aca* or *Sambat*.

NOTE *to an* ESSAY *on the* CAMPHOR-TREE *of* SUMATRA; *by* H. T. C.

Since my return to England I have had the opportunity, by the indulgence of Sir JOSEPH BANKS, to inspect the specimen in his collection from which the younger GÆRTNER, to whom it was communicated, described his Dryobalanops aromatica; and I find that the leaves entirelv agree, and that it is unquestionably

the same species with the Camphor-tree of Sumatra. This information actually accompanied the specimen seen by Dr. C. F. GÆRTNER, though he has inadvertently referred it to Ceylon for a habitation, and as erroneously alleged, that the bark of the tree is cinnamon.

The fruit has been also figured and described by M. CORRE'A DE SERRA, (Ann. du Mus. d'Hist. nat. 10. 159,) under the name of Pterygium teres; equally without any intimation of the tree affording the Sumatran camphor.

As the Pterygium costatum of the same author is the Dipterocarpus costatus of the younger GÆRTNER, whose publication on both that and the Dryobalanops preceded by a year the earliest of CORRE'A DE SERRA'S concerning these fruits, it is presumed, that GÆRTNER'S names of both genera will be retained. Whether his name of the species now in question shall also be preserved, others must determine. It is, however, to be remarked, that the name which was given to it in India, before the identity of species could be ascertained, is the most appropriate.

The flowers of this plant, in Sir JOSEPH BANKS'S collection, are in too imperfect a state for description. It appears, however, as was to be expected from analogy of congeners, that the petals are five, and the stamina numerous. It belongs then, as most of the plants of the same natural order do, to the class and order Polyandria Monogynia. The essential generic character is:—Calyx one-leaved, permanent; enlarged into a gibbous cup, with five ligulate, long, scariose wings. Corol. five-petalled. Capsule, three-valved, one-celled. Seed solitary. Embryo inverse, without perisperm.

W. Clowes, Northumberland-court, Strand.